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Vol. 21, No. 7 July, 1953

Organic Gardening

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the reincarnation of a fish head

I am a commercial fisherman and live on Mobile Bay where most of the soil is sandy without any clay subsoil. For eight years my garden was a sorry sight. Commercial fertilizer would fade away in the sand over night. What few struggling plants that managed to take root, were soon shriveled up by the summer sun. I finally gave up the idea of trying to raise a garden. Then one day while running my tackle, I was caught in a gale and had to make a run for the local yacht club at Fairhope. My catch consisted of five hundred pounds of Spoonbill. I dressed out in the yacht basin but could not throw the heads and entrails overboard, so was compelled to haul them away. I didn't want to stink up the country with the fish scraps so I took them home and buried them in the abandoned garden plot. A few weeks later I noticed a luxuriant growth of grass where I had buried the fish. This gave me an idea. If fish would make the grass green, why

---

THE COVER

"Wagon Tale" is a colorful mirroring of gardening pleasures ahead. As summer rolls on, the planning and work of seasons before bring a joyous bounty and a happy toiler. Once again, ORGANIC GARDENING'S Karl Manahan offers a cover delightfully alive and captivating.

wouldn't it work equally as well on vegetables.

The Spoonbill run was unusually large the following winter. I saved every scrap of fish, including shark and rays and planted them in rows, after which I limed them heavily and covered them deep to prevent dogs and cats from digging them up. When spring planting time arrived, I proceeded in the usual manner with the planting and cultivation. Most of the plants were mulched with oak leaves after the first cultivation. The results were amazing. The vegetables I raised were equal to any raised on heavy potato soil. My fertilizer problem has been solved without any cost, and my garden continues to be a show spot of the community.

Walker D. Wallace
Fairhope, Alabama

Abundant Organic Tomatoes

Your readers may be interested to know of some experiments with tomato plants in a growing season of about 100 days, or a little better. We set stakes three feet apart each way and set two plants to a stake. Side growth is pruned off six to eight inches above the ground.

We have not had success with a heavy straw mulch on tomato plants, but we have benefited by the follow-

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ing procedure. When taking apart a compost heap there are coarse clumps or lumps which we ordinarily throw into a new heap. Take this coarse material and pack it all over the ground between the tomato plants to a depth of six to eight inches. It thus becomes a mulch of semi-broken down compost.

We have had abundant, fine tomatoes as a result of this practice.

Scott Nearing
Cape Rosier, Maine

profit from organiculture

Have sold lots of fruit locally; culls, drops, etc., this year. People come from Naples and Fort Myers regularly for it, and keep me pretty well cleaned out. They say they can't get fruit with such good flavor elsewhere. I attribute the flavor to the fact that I use organic fertilizer (mulch, sawdust, and sheep manure), and no poison sprays. Last year and again this year I got 130,000 ladybugs from California, and they do the work the sprays are supposed to do, and they are a lot cheaper. I never did like arsenic!

Edwin P. Nutting
Bonita Springs, Florida

pointers for Brazil

Only recently has the idea of composting invaded Brazil. Our coffee planters have not been willing to start mixed farming. They grow nothing but coffee and will not keep animals or devote any land to grazing. Even leguminous crops are considered improper in these plantations. While the coffee price is high, the land is given chemical fertilizer and more frequent hoeings, both accelerating erosion.

During the many years the price of coffee was low since 1921, most plantations did not receive any treatment whatever except harvesting and even this was not always done as it would not pay. Actually with prices high, there is a strong movement towards recuperation of old run-down plantations on eroded land, and some fine work has been done in the Sao Paulo State with replanting of plantations in contour level, leguminous crop rows and artificial irrigation. A few of the most learned coffee planters near the big towns even started mixed farming with part of their land devoted to grazing for milk production. They had some success and could have had more had they also adopted the making and use of compost. However, it is hard to get our peasants to do a job they are not used to doing. Most of our rural population tire themselves out with the hoe and have no time left for thinking of gathering litter and dirt to make compost. Most of these rural workers are nomadic, getting their pay in form of a share of the crop, and will not move a hand to improve the soil which is not theirs to give a better crop next year for someone else.

In the past twenty years of low prices, many millions of coffee trees in Brazil have died from lack of treatment, and what is worse, the land eroded badly. One can frequently see plantations with gullies ten feet deep cut into the soil, with dead trees standing on the top of blocks and towers of soil. In tropical land agricultural crops of permanent nature must be attended to better than annual crops in cool climates. Compost farming is the solution where it can be done. This means mixed farming and a well-directed group of rural workers, each family attending one specialty, the whole according to a general plan. The old routine of migratory workers contracted for one season's job, which is the rule in Brazil, must be upset before a modern system of soil conservation can be introduced. It is a social problem rather than a problem of knowledge and capacity. Of course there is lack of money behind the problem too. Tractors, implements, trucks, pumps and

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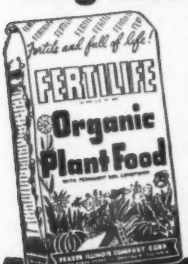

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Yet, about eight years ago, a man who had bought a plantation in the Sao Paulo State, found after completing the transaction that he had acquired a desert, a run-down coffee plantation—badly eroded, bare of humus and practically out of production. He started making compost from bog weeds, castor and coffee bean shells, rice chaff, bone meal and the little animal manure he managed to obtain. After three years, he has the most productive yields of the entire area—and his neighbors have started imitating.

Harry Blossfeld
Sao Paulo, Brazil

southwest agriculture problems

I was probably an early subscriber to your *Organic Gardening* in this locality, and have found much interest in this very worthy and ambitious magazine.

I grew up on my father's farm near Bridgeton, N. J., where the problem was acidity. Here, in the Southwest we have almost the extreme opposite, that of alkalinity, and, as you must know, this condition exists from here northwesterly in a belt several hundred miles wide and twelve or fifteen hundred miles long. The source of the Rio Grande is in the San Louis Valley of south central Colorado, and its watershed included inland seas in comparatively recent geological times. Such seas probably existed in the present watersheds of the Colorado and the Snake Rivers in similar eras, and the comparative aridity of the entire area has delayed the leaching away of soluble sea minerals.

Most of this commentary was stimulated by your phrase "tropical plant growth." However, plant growth here might be more properly classified as desert or semi-arid plant life. It is

true that many sub-tropical plants can be made to thrive in our locality where irrigation is possible, but the natural history of the area is decidedly desert in background.

When I first came here in 1930 the annual rainfall was reported to be about 28 inches. However, I doubt if it will total 18 inches this year, and today we are critically short of water, having been getting barely enough for domestic and municipal purposes. This means that farming has almost come to a standstill. This drought has gradually increased in the past three or four years, and exists in large areas of Mexico and Southwestern U. S. If there is not a turn for the better soon, we will have a second Dust-Bowl.

One of the most important things to be realized about organic farming in the southerly portions of the U. S., and especially hereabouts, is that organic matter is used up by bacteria at a much faster rate; and consequently more effort and expense is required to maintain a sufficiency of it. We have at least six months of hot weather, and it is only our proximity to the Gulf of Mexico that makes life endurable here in summer.

Benjamin H. Shoemaker
San Benito, Texas

(*Continued on page* 62)

"... And don't look so proud when I call you a worm."

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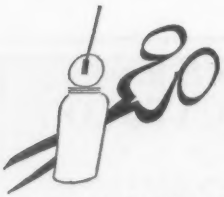


WITH THE EDITOR

Part V

are we using too much compost?

Subsoil as a soil amendment—
a startlingly new concept

J. I. RODALE

While we are on the subject of too much compost let us look at the other end of the tether—the subsoil. When we speak of soil fertility we think only of the topsoil. In fact the average farmer and gardener regard the subsoil as some sort of enemy —a calamity when they see a little of it coming up into the surface layer. They do not consider it much less than a poison, and feel that something terrible is going to happen to the coming plants because of it. We often hear the term, *the unproductive* subsoil. But this is a serious error. In order to understand the proper relationship between the upper and lower levels of soil let us consider the definition of the word *soil.* One writer refers to it as a more or less loose and friable (tending to crumble) material in which, by means of their roots, plants find a foothold and nourishment, as well as other conditions of growth. Subsoil is usually not as loose as topsoil but otherwise, according to this definition, it fits the description. It provides a medium for the roots to hold. It gives nourishment to them and serves other functions. In fact, when all is said and done, it will probably be found that the subsoil is of equal importance with the topsoil, which reminds me of a case that came to my attention a few years ago. A man had purchased a house, discovering that the grounds had been filled in to a depth of 12 feet with wonderful topsoil that had been excavated from the site. His eyes gleamed as he stirred his fingers through the fertile soil. What wonderful plants he would grow with this manna from the heavens! But alas, he experienced nothing but misfortune with the plants that grew in it. There was disease, oversucculence, and poorer results than he was normally accustomed to achieve in his gardening activities. He had overlooked the fact that plants have been bred by nature over millions of years to have their feet in subsoil. It was as if he was giving them a meal that consisted entirely of dessert.

Let us study this subject a little further and note the variations that exist in the action of topsoil versus subsoil. First we must understand that the microorganisms—the bacteria and fungi—are far more numerous in the topsoil where, in the upper soil levels they may reach to billions per gram of soil, in the subsoil three feet down, there may be only thirty or forty thousand per gram. In the topsoil the earth is alive with these wrecking crews, for it is there where the plant and animal remains have to be broken down. This is one function that can be performed only in the topsoil. Bury a piece of cotton three feet down in soil, and it will remain undecayed for a long time. In the topsoil it will disintegrate in a few months.

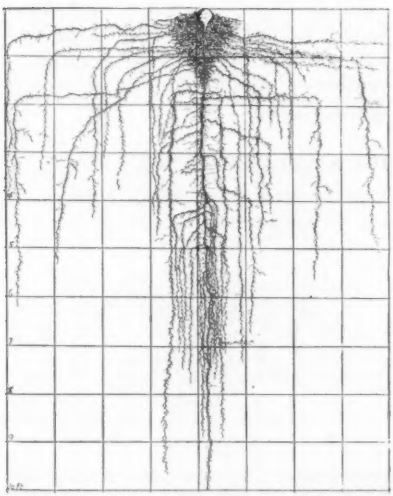
At the surface, the bacteria are at

work synthesizing food. This is another function that is at a lower ebb in the lower depths, but nevertheless it is an important activity that takes place in the subsoil. It is a material and valuable source of mineral food for crops.

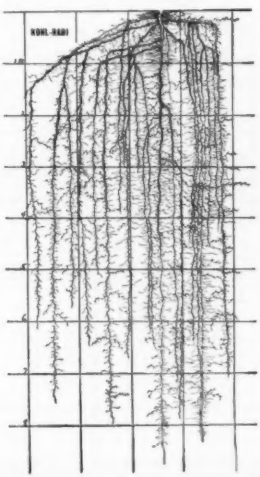
We are concerned here with a consideration of the means used for transferring some of this mineral matter into plants. The earthworm is one agent that performs this task. It burrows in the subsoil, eating some of it as it goes, bringing it up to the surface and depositing it there in the form of castings. This should give us a hint. Why can't the gardener do the same thing? Here is an opportunity for some enterprising manufacturer to put on the market a tool which can take tiny amounts of subsoil from three to four feet below the surface without disturbing the topsoil. At those depths there is less likelihood of the existence of mineral deficiencies. This might be especially desirable if one has put too much compost into the topsoil.

The roots of trees perform a similar office to that of the earthworm, but in a different manner. Some tree roots descend to depths of twenty feet or more and bring into their leaves a rich store of minerals, so that when the latter fall and decay they deposit a precious treasure to the topsoil. The roots of some ordinary crops go much deeper than suspected, and are able to draw in mineral sustenance from low subsoil levels. In 1945 we published a booklet (now out of print) which was a condensation of the Weaver and Bruner book (now out of print) *Root Development of Vegetable Crops* (McGraw-Hill, 1927) which gives amazing examples of plant root depths. We are reproducing herewith some of the illustrations demonstrating some astonishing facts:

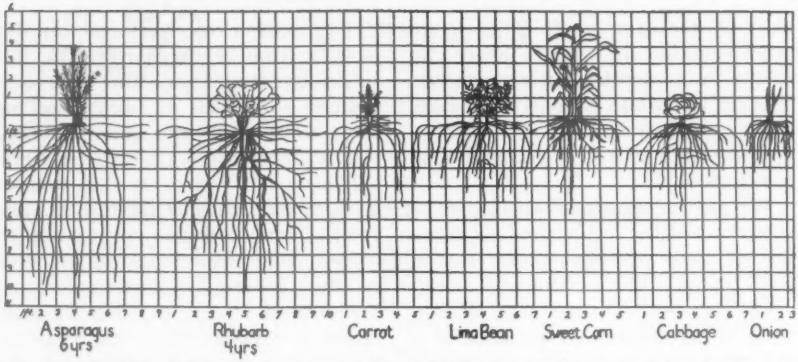
One of the advantages of such large root-systems is that when the plant dies the roots are absorbed by the soil (subsoil as well as topsoil) and furnish much fertilizer value. These roots are extremely rich in nitrogen, phosphorus and potash as well as the trace



Beets have a very pronounced taproot which, by August, extends to the 10 ft. level. The entire branching system forms, with the taproot, an efficient absorbing system in the deeper (2 to 8 ft.) soil. All the main roots are profusely branched but with short laterals.



Kohl-rabi has a well-developed taproot extending 3 to 4 ft. in the soil. Numerous wide spreading branches are ramified with dense network of rootlets usually in first two feet of soil. A few obliquely descending rootlets and the taproot may penetrate 4 feet deep.



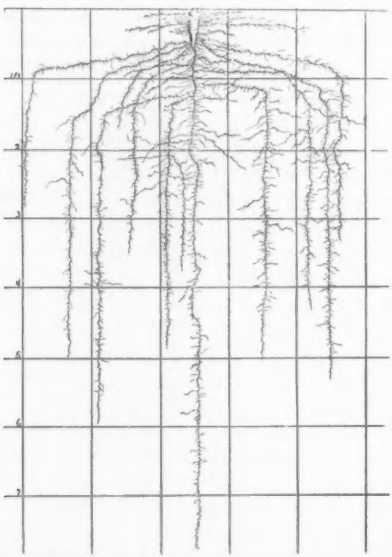
This, and the chart on the opposite page, graphically depicts the differing root systems of our more popular vegetables. Some, such as the asparagus and horseradish, have very extensive root systems which penetrate deeply into the soil. Other varieties have small taproots with a system of wide-spreading lateral feeding roots.

mineral elements. In the case of a stand of two-year old clover, over three tons per acre of roots were left in the soil as a residue, which contained 180 pounds of nitrogen, 71 pounds of phosphoric acid and 77 pounds of potash. It is interesting to note that there is a greater abundance of roots in plants growing by the organic method. This has been proven so conclusively that there can be no question as to its accuracy. This amounts to significant additional poundage of dead roots per acre.

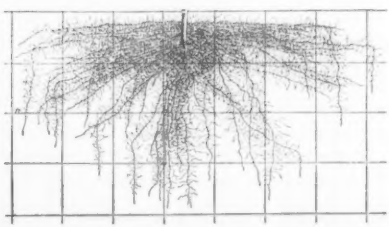
We may add also that roots, as they penetrate into the subsoil, make long holes which provide drainageways for moisture. Here again, by the organic method there are more and wider holes. Between the earthworms' burrowings and the roots' penetration, a refractory subsoil can be kept adequately open.

the mycorrhiza

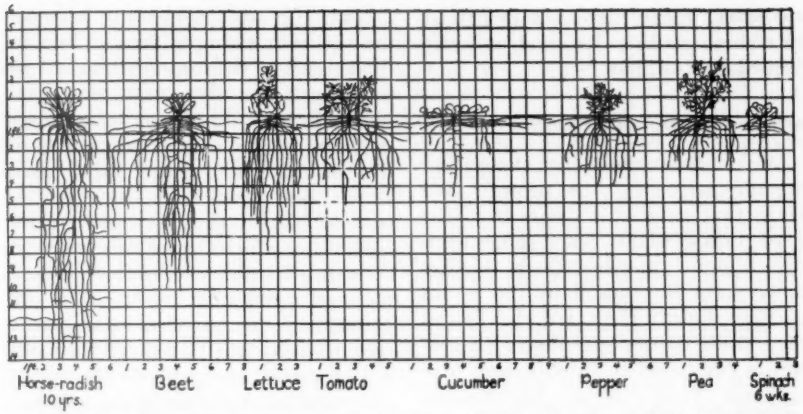
Since there are fewer bacteria at the lower levels to aid the roots in



Carrots have a strong, deep, well-developed taproot system. Taproots 4 to 5 ft. deep have very poor branching. The few laterals extend horizontally 8 to 10 ft. in first four inches of surface soil. From the lower half of the fleshy portion of the taproot, a profuse network of horizontal branches extends outward into the surface soil.

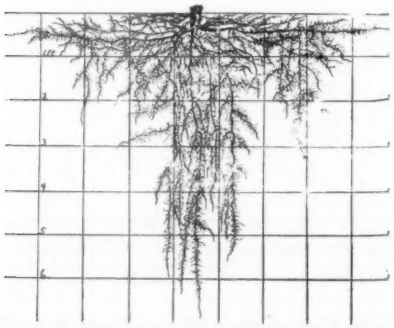


Peppers have a widely and deeply spreading root system which thoroughly occupies the surface layer of soil. The usual spacing of plants, 18 inches apart in rows 2 to 3 feet distant, is not so great but that all of the soil is thoroughly occupied by the roots. From the taproot and base of stem, there are numerous profusely branched laterals.

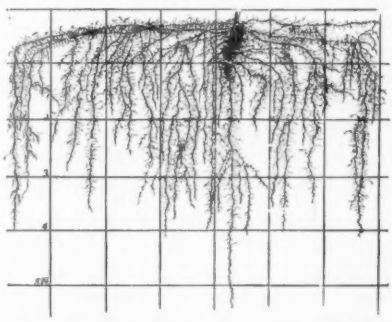


Feeding roots in some vegetables such as Peppers, form a network in the upper surface of the soil. In others, such as rhubarb, these lateral roots start growing in the upper layer of soil but an extensive lateral growth may also occur 3 to 4 feet below the surface of the soil. There is a wide difference in the root structure of plants as shown above.

gathering food, Nature has found other means to perform this task. The root hairs themselves are active in drawing in nutriment from the soil's water solution. But we must not overlook the function of the mycorrhiza, a fungus which grows on many plant roots and which lives in a symbiotic relationship with it, that is, each giving something to the other. The mycorrhiza is enabled to live while it transforms substances from the soil into a food for the roots. Eventually the entire mycorrhiza is consumed by the roots as food. Experiments have shown that where chemical fertilizers are used, the mycorrhiza is either absent or of small extent, and it is not finally absorbed into the plant. In a healthy mycorrhizal association, humus is needed as part of the food picture. I mention this subject here because thus far in the literature of the organic method the point I make has not been stressed. In fact, it has not even been mentioned. What I mean is that the mycorrhiza may be the specific vehicle to operate at sub-



Swiss Chard is characterized by a strong taproot having many strong lateral branches, all of which originate in the first foot of soil. Mature taproots, 2 inches thick, taper rapidly, penetrating 6 or 7 feet into the soil. They have strong, widely spreading, horizontal branches, with long, profusely rebranched laterals in first 2 ft. of soil radiating 3½ feet from plant.



Beans, of both lima and kidney varieties have very similar root systems. In early growth, beans develop a taproot (which, when mature, is 5½ ft. long), with very abundant horizontal lateral branches; others arise adventitiously from the base of the stem. The root system, conical in shape, when fully mature has widely spreading, nearly horizontal branches 2 to 4 ft. in length.

soil levels where there is a dearth of other biologic life. Research is badly needed in this field.

organic matter in subsoil

We must not think that there is no organic matter in the subsoil. We know that some of it comes from the dead roots of plants. Some comes from the organic matter which leaches down from the topsoil by the action of rain water. Here are the figures of a study of organic matter in topsoil as compared to subsoil from Millar and Turk's book, *Soil Science* (Wiley).

	Top Soil	*Sub Soil*
Rushton fine sandy loam (N. C.)	.88	.17
Durham Sandy loam (Ga.)	.86	.19
Miami silt loam (Mich.)	4.64	.68
Barnes silt loam (S. D.)	7.30	—
Fox loam (Mich.)	3.58	.38

There are cases where the subsoil has more organic matter than the topsoil.

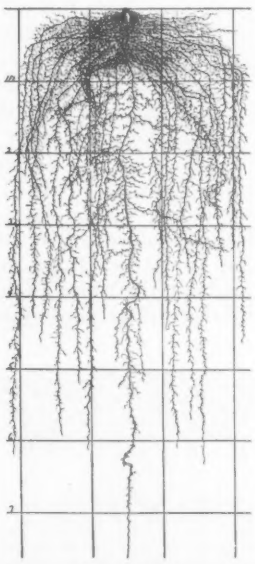
mineral matter of subsoil

Many subsoils are extremely rich in mineral matter, having been formed from the parent rock underneath. The minerals, then, form from the bottom up and the further down you go, the more unexhausted they are. In some cases the subsoil represents aggregations of glaciers which are extremely mineral-rich.

The following is a comparison of two sets of top and subsoil minerals from U.S.D.A. Tech. Bul., 229, 1930:

	Miami Soil Series		*Cecil Series*	
	Top	*Sub*	*Top*	*Sub*
Silicon	49.8	46.3	37.5	36.4
Aluminum	25.3	25.3	36.4	35.4
Iron	9.4	10.4	10.5	13.2
Calcium	.76	3.14	.21	.14
Magnesium	2.09	3.16	.44	.27
Potassium	2.67	4.47	.71	.49
Sodium	.23	.24	.05	.07
Titanium	.75	.61	.94	.92
Phosphorus	.29	.19	.21	.21
Sulphur	.20	.13	.13	.17

Note the wide variations between the two. For example the calcium in the subsoil of the Miami series is 3.14 whereas it is only .14 in the Cecil series. But the Titanium in the latter is about 50 per cent greater than in the former. There are other soils which show even wider discrepancies or differences. What am I leading to? Something which I think has not been thought of before—*the use of subsoil material from one region as a soil amendment for another, to be placed into its topsoil!* This would be one way of correcting mineral deficiencies. The Chinese have a regular practice of spreading canal and river mud over their soils, but this of course is mostly topsoil rich in organic matter which has washed off their land. However, why not go a step further and dig deeper for more minerals?



Lettuce has a rapid-growing taproot, sometimes at the rate of an inch a day. First laterals are horizontal, very near the soil surface, and extend outwards up to 18 inches before turning downward. Maximum depth achieved is 6 ft.

Our experimental farm is between Allentown and Emmaus, Pennsylvania, in the Lehigh Valley. In the

nearby Pennsburg region is a mineral-rich red soil which is most fertile. An old inhabitant of that section tells me that it is a known fact that those farmers who farmed on these red soils all became rich, while those on the neighboring brown soils just about were able to make ends meet. As I drive through this section my mouth waters when I see piles of red soil dug up out of excavations for new houses that will soon be hauled away to dumps or for non-agricultural fill-ins. What a wonderful soil amendment this would be for the neighboring brown soils! Gardeners should travel with some kind of equipment—baskets, tins, etc., so that they can gather up some of this unwanted soil for assuaging the mineral needs of their topsoil.

In the other direction from our farm, going westward is the gravelly, shale soil region which is potato growing country. A mixture of this shale subsoil with that of the Pennsburg red would be just what the doctor ordered for our soil which is called Hagerstown clay loam—a heavy clay soil which could stand a little "opening," as well as enriching.

Some of the arid desert soils of western U. S. are terrifically rich in minerals, for the reason that there is not sufficient rainfall to leach them down to the water-table. Irrigation usually makes such soils blossom with luxuriant crops. The government could very well ship out some of these subsoils by the carload to neighboring farm lands as a subsidy. They do it now with regard to lime and other fertilizer materials.

Years ago, on a cross-country train, I met a party consisting of some English people. As we were going through some dry desert sections of New Mexico, one of them commented on the barrenness of the soil. I explained to him that this was not so, that were it not for a lack of water the land would pour out a lavish abundance of crops. Just as I spoke, we passed a small pond of water, the land surrounding which was made up of the same type of arid soil, but all around it was an example of the idea I had tried to convey—a grove of large, sturdy, rich-looking trees. They saw the point at once.

The question is, what will the addition of subsoil do to a topsoil? Will it "spoil" it in any way? Will it depress its ability to produce a satisfactory crop? The answer is, I believe, that it must be done judiciously. I would say that in an average garden a layer of about a half inch of subsoil well-mixed into the upper six inches could be taken into its stride by the soil. If your soil is well supplied with organic matter, which means that it is abundant with bacteria and fungi, on the first rain they will be washed into the new material and go to work on it. In a few days they will thoroughly saturate every pore space of it and thus break down its rawness. The gardener can help along the process by watering. Weir, in his book, *Soil Science* (Lippincott) says that if even large quantities of raw subsoil are plowed up to the surface, it probably will become sufficiently weathered before planting time. I think, however, that there are cases where a farmer has plowed too soon after a rain, and the subsoil has been churned up in big, undigestible, cloddy lumps, which will surely lead to trouble. Weir says further, "Hilgard (1892), observing normal growth of vegetables on some desert soil material that had been excavated from depths of from 7 to 10 feet, concluded that subsoils of arid regions gave no evidence of infertility known as 'rawness.' C. B. Lipman (1917) has observed that arid subsoils are but little, if at all, less raw than those of soils of humid regions. . . . In his discussion of this problem, Alway (1918) has stated that the generally accepted idea regarding the rawness of subsoil materials in humid regions is not based on pot experiments. . . ."

There you have it! Very little is known about the action of the subsoils in growing plants. Here is a tremendous field for research. There are regions that contain muck soils which are oversupplied with organic matter, but which are lacking in minerals. Such lands exist in Michigan, in the Everglades of Florida and in other regions. They should do well with copious additions of mineral-rich subsoils from other sections which could be quarried on a commercial scale. Heavy clay soils can be aerated by such augmentations while very sandy soils could be "plugged" with clayey subsoil material. All it needs is some research and a development of the proper material handling equipment that would not make the cost prohibitive. Here is an opportunity for a new industry. I can see a com-

blueprint for

A success story in organic gardening which points the way to good results in otherwise near-barren localities

How can yellow clay, strong dry winds, hail stones and an altitude of 7,500 feet be synonymous with a beautiful garden? Most people might think these factors would prohibit a garden of any sort, yet Mrs. Helen Princell of Los Alamos, New Mexico has discovered how to foster the best in nature at a high altitude and minimize those elements which are detrimental.

While residing in more adaptable climes Mrs. Princell found an opportunity to garden, yet she didn't hesitate at obstacles which would awe experienced gardeners. Her original attempts were the culmination of careful study during the first winter she spent atop the mountainous plateau of the Atomic City. By perceptive selection, she determined to follow organic methods exclusively.

It was a surprised and happy Mrs. Princell who captured blue ribbons for snapdragons of the Red Cross, Loveliness and Velvet King varieties which she exhibited at the state-wide flower show held at Santa Fe, New Mexico, the first year of her flower raising efforts. The following winter she once more continued her study of organic gardening practices and prepared for the next planting season by laying up a compost heap.

"It's at a time like this," says Mrs. Princell, "that the interest of a husband is invaluable, for without his help, exciting jaunts in search of prospective compost material would be far less successful." At home she found a shredder of great aid in cutting up clover, alfalfa and sunflower stalks to augment her supply of handier material.

By planting the seed directly into the ground during the last week of May, she found that young shoots were not damaged by spring frost, hail and strong winds, typical to this region during March and April. Within five days to one week, her efforts were rewarded by tiny promises of bet-

pany which stocks 29 different subsoil materials, put up in neat packages, each with its printed mineral analysis on it. The gardener sends in a sample of some of his soil from the upper and lower levels and the company, after analyzing it, suggests three or four different subsoils which he is advised to purchase. I know that someone is going to do this some day! There is no charge for the idea, and no patents.

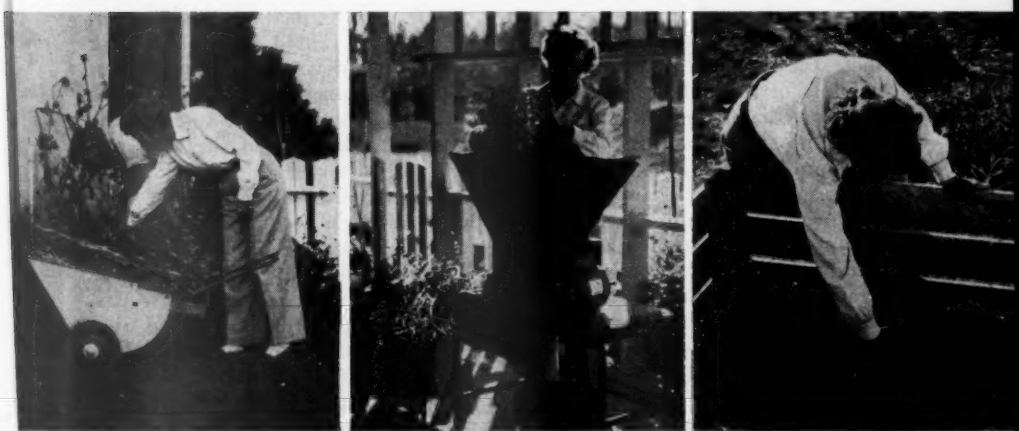
In closing I wish to stress again that too many organic gardeners have been pulling in an unbalancing direction, piling unneeded amounts of organic matter into their soil, while neglecting the mineral side. Of course, they are using the rock powders—the phosphate, potash, basalt, lime, etc., but here is an entirely new conception of soil fertility. I hope it will be given some consideration.

high altitude gardens

RUTH BOMBARDT, N. M.

ter things to come. As soon as her plants reached one inch in height, grass clippings were pressed into the surrounding soil of each one which quickly formed mulch. When these plants were approximately six inches high, the compost was added and her efforts began to bear blooms which were astonishing.

Every annual type of plant blossomed without fail, and her perennial dahlias and chrysanthemums thrived



Left, Mr. and Mrs. Princell gather dried foliage and flowers to prepare compost. Center, shredding compost material in an automatic grinder. Right, examining compost material in a specially built bin.

Photo: U. S. Atomic Energy Commission

The sun-baked earth of this locality does not lend itself to good plant growth unless ample organic matter is incorporated in the soil.

as well. The phlox which she planted in varieties of Mary Louise, Charles Curtis, Africa and Blue Boy attained large sizes and asters not only grew to a height of three and one-half feet, but the flowers themselves were quite full, while gladioli attained unusual depth and range of color.

Since Mrs. Princell's greatest disappointment during the previous season had been her day lilies which had refused to bloom at all, she determined to experiment. While reading *Organic Gardening* magazine, she noted that rock phosphate fertilizer was recommended for v e g e t a b l e growth and decided to try its effects upon the lilies. By pressing small amounts of rock phosphate into the soil immediately about each plant, she achieved blooms that were extra-large and hardy. At the end of 1950's growing season, Mrs. Princell's garden was covered with compost layers. Unable to obtain active manure, she found that the addition of an all-organic soil conditioner was the best choice of an activator for this dry region because it is packed dry and therefore did not become lumpy or hard to manage as do those with liquid content when exposed to this dry air. To thwart forthcoming winter storms, she placed a cover of winter mulch upon her garden, securing the mulch by intertwining pine branches to prevent erosion.

Early in the spring of 1951, Mrs. Princell performed her pre-planting duties and with surprise noted that the soil turned easily revealing that what had once been hard clay, was now soft rich loam. She avoided deep gouging and lightly troweled most areas. Wet burlap was placed over her freshly planted seeds to prevent dryness.

The first week of September brought forth the hoped for results. The four to six inch compost brought blooms that caused passers-by to ask permission to visit and admire. Out of town visitors were impressed by the wide range of colors presented in the blossoms. Members of the local garden club dropped in to seek advice and Mrs. Princell aided many of those who had never used organic practices to begin a compost heap.

While aphids were a source of grave concern to most local gardeners, Mrs. Princell's sturdy plants survived only a mild onslaught. She attributes their downfall to the presence of ladybugs and the strengthening effect of composting. The main problem was cutworms and these were kept under con-

(Continued on page 44)

COURSE IN ORGANICS

By J. I. Rodale

ORGANIC MATTER

Lesson VI — Carbon-Nitrogen Ratio

THERE are two chemical elements in organic matter which are extremely important—especially their relation or proportion to each other. They are carbon and nitrogen. This relationship or proportion is called the *carbon-nitrogen ratio.* To understand what this relationship is, suppose a certain batch of organic matter is made up of 40 per cent carbon and 2 per cent nitrogen. Dividing 40 by 2 one gets 20. The carbon-nitrogen ratio of this material is then 20 to 1, which means, twenty times as much carbon as nitrogen. Suppose another specimen has 35 per cent carbon and 5 per cent nitrogen. The carbon-nitrogen ratio of this material then would be 7 to 1. Anyone who handles organic matter, who mulches or who composts—regardless of which method is used—should have some idea about the significance of the term carbon-nitrogen ratio.

Carbon is important because it is an energy producing factor, nitrogen because it builds tissue. We are familiar with carbon in the form of charcoal. In that form it is practically pure carbon. A diamond, of any color, is another form of pure carbon. In a plant it takes an entirely different form. Limestone is usually over 90 per cent calcium carbonate, a compound made up of two partners—calcium and carbon. If you eat a radish or take bicarbonate of soda, you are consuming carbon. So we see how widely distributed carbon is. Carbon can be a gas, an acid or other form of compound. I need not say much about nitrogen, for it is a term with which every gardener and farmer is familiar. A certain amount of it is essential for plant health. Too much is undesirable. There is no evidence that too much carbon will cause disease in plants, but such a state, that is too much carbon content, is not wanted, as you shall soon see. When organic matter decays, the carbon is dissipated more rapidly than the nitrogen, thus bringing down the carbon-nitrogen ratio.

EXAMPLES OF RATIOS

Before we go further and study the significance of the carbon-nitrogen ratio, let us look at some figures—examples of typical materials and their specific carbon-nitrogen ratios. Here is a list as obtained from several sources:

Young sweet clover	12 to 1
Alfalfa hay	13 to 1
Rotted manure	20 to 1
Clover residues	23 to 1
Green rye	36 to 1
Sugar cane trash	50 to 1
Corn stalks	60 to 1
Oat straw	74 to 1
Straw	80 to 1
Timothy	80 to 1
Sawdust	400 to 1

Note the high carbon-nitrogen ratio of sawdust. Such a material would be called highly carbonaceous, and has a very low nitrogen content. If much of it is put into the soil, there would not be enough nitrogen, which is the food of bacteria and fungi which have the

function of decomposing it. They would thus have to consume soil nitrogen and create a deficiency of it, thus depressing the crop yield. It would do well for the farmer and gardener who applies organic matter to be conversant with the carbon-nitrogen ratio of the different materials he handles. Generally speaking, the legumes are highest in nitrogen and have a low carbon-nitrogen ratio which is a highly desirable condition. The above figures are not standard, but vary greatly, depending on particular conditions under which the plants grew. Straw, for example, could go to as high as a 160 to 1 ratio, whereas the above gives it as 80 to 1.

There is a difference between the carbon-nitrogen ratio of raw organic matter and that of humus. As we have seen in a previous lesson, the nitrogen in a leaf may be only one per cent, but by the time it turns to humus, the percentage of nitrogen of that more or less refined substance would be about 5 per cent. The average of nitrogen of practically all humus is about 5 per cent, but that of organic matter fluctuates considerably. However, with regard to carbon, a different condition exists. While organic matter in decomposing does lose large arounts of carbon as it turns to humus, the percentage of it to the total mass does not seem to go up or down too much. Thus, if you start with some rotted manure that has a 40 per cent carbon and 2 per cent nitrogen content which gives a carbon-nitrogen ratio of 20:1, you may wind up with a 10:1 ratio when it turns to humus: that is, a 50 per cent carbon and a 5 per cent nitrogen content. There is always a narrowing down of the carbon-nitrogen ratio when organic matter decomposes. The content of carbon in humus does not vary too much. It averages about 50 to 52 per cent.

THE SOILS' CARBON-NITROGEN RATIO

The carbon-nitrogen ratio of the soil is on the average much less than that of organic matter. By the time green matter is decomposed in the soil the C:N ratio has dropped to much lower figures. Waksman in his book *Humus* gives typical figures. Some brown silt loam soils of Illinois were about 12:1 in the topsoil, 11½:1 in the subsurface layer and 9:1 in the subsoil. The ratio always declines as one goes downward. In the Broadbalk plots (England) the C:N starts at about 9:1 and declines to about 6:1 seven feet down. Waksman cites a black clay loam at 12:1 in the topsoil and 9:1 in the subsoil. As the age of the humus increases, says Waksman, the C:N ratio of the soil in which it is, becomes lower. In eight soils in Northwestern United States the C:N average was 12½:1 in the top 6 inches and 9:1 about 3½ feet down.

THE BACTERIA AND CARBON-NITROGEN RATIO

We have seen that raw organic matter has a higher carbon-nitrogen ratio than humus or of the average soil. We shall now study the C:N ratio of the microorganisms of the soil, and we will find that it is usually much lower than that of organic matter, humus, or soil. The average C:N ratio of the bodies of bacteria and fungi falls between 4:1 to 10:1. Why is their C:N ratio always less than that of the humus in which they work? The answer is that they require more protein than carbohydrates. Protein is needed for tissue building mainly, while carbon of carbohydrates is for energy. Humus is made up to a great extent of lignins and other high-carbon material. In other words humus has more carbohydrates than the bodies of microbes, which are extremely high in protein, and since about 16 per cent of protein is nitrogen, we can see that the microbes' bodies will have a very high percentage of nitrogen to carbon. Usually the tissues of bacteria are richer in protein than that of fungi.

When much raw organic matter is applied to a soil, the microorganisms will multiply rapidly, but in the process of working they have to consume nitrogen. That is an absolute necessity

to their existence. Now, if the material that is plowed under has a low C:N ratio, that is, it is low in nitrogen, the soil organisms in decomposing it will have to look for their nitrogen in places other than in the decomposing substances. They will draw on the soil's store of nitrogen, thus depleting it, with a depressing effect on the crop yield. But their bodies are now gorged with nitrogen and when they die, future crops will benefit. This shows that when plowing under highly carbonaceous organic matter, a sufficient period of time should elapse before the crop is planted. It will give the soil organisms time to die, so to speak, to give their bodies to their country. Or, one should try to use organic materials with a low C:N ratio, which means a high nitrogen content.

One investigator (Broadbalk) discovered that where the C:N ratio of added organic matter plowed under, was 33:1 or more, a withdrawal of nitrogen occurred. Between 17 and 33 nothing was added or withdrawn; in other words, nitrification ceased. But if it was under 17, the nitrogen store of the soil was increased. This shows the value of adding compost to the soil, because its C:N ratio is usually quite low.

The practice is, when plowing under organic matter with a high C:N, to apply with it a high nitrogen fertilizer. The organic gardener can use for such purposes dried blood, bone meal, hen manure, cotton seed meal, fish scraps and dried ground fish, peanut shells, silk and wool wastes, castor pomace, cotton gin wastes, cowpea and soybean hay, felt wastes, feathers, hoof or horn meal, a number of other organic materials having a high nitrogen content.

Russel in his book *Soil Conditions and Plant Growth* (Longmans) gives an interesting illustration of a comparison between the earthworm and microorganisms in reducing the C:N ratio of rye-straw. He says, "Thus, L. Meyer found that earthworms feeding on rye-straw composted with basalt meal reduced its C:N ratio from 23 to 11 during a period of two years while the soil microorganisms alone reduced it to about 18 during the same period." This means that the earthworm is a better conserver of nitrogen than microorganisms.

THE SIGNIFICANCE OF THE C:N RATIO

We have already seen that the C:N ratio of plowed under organic matter is important to the conservation of the soil's store of nitrogen. It is also of great significance to the general operation of soils. Mainly, it is a matter of having enough nitrogen available. There is a difference in the way a low C:N ratio works, depending on whether it is in raw organic matter or in humus. In Lesson IV of this series we discussed the dynamic action of organic matter, and showed that organic matter, applied to the soil, represents nitrogen on the move. In a finished compost it is in a more static condition. Less is given off. In terms of C:N ratio we can express it in the following manner. In the application of raw organic matter, the extent of nitrogen movement depends on its C:N ratio. If it is high, like in sawdust (400:1) there will be no nitrogen movement, but if it is a material like young sweet clover (12:1), there will be a very satisfactory rate of nitrification.

In humus, however, although the C:N is low, let us say 10:1, there is a resistance to rapid decomposition. The movement is slower, and will take place over a longer period of time. This is of some value as it means the nitrogen is stored for future use. In the case of fresh organic matter with a low C:N, not only is there a fast nitrogen movement, but much carbon is given off in the form of carbon dioxide. It is thought by some that this may kill off some of the larvae of destructive insects.

AGE OF ORGANIC MATTER

The younger the plant material is, the lower the C:N ratio, which means that it will not only decompose more quickly, but will release more nitrogen

and increase the yield. Louis M. Thompson in his book, *Soils and Soil Fertility*, gives the figures of an experiment with wheat that is typical:

STAGE OF GROWTH	C:N RATIO
Very young	16
Well headed	27
Almost ripe	41

This experiment showed that the lower the C:N the more nitrates were added to the soil and more growth of wheat occurred.

Sir Albert Howard in *An Agricultural Experiment* says: "In Rhodesia crops of *san* hemp are now regularly grown to provide litter, rich in nitrogen, for mixing with maize (corn) stalks so as to improve the C:N ratio of the bedding used in the cattle kraals." I cite this to show that organic farmers and even gardeners can grow special material for use in providing the best kind of organic matter for their crops, and in some cases it may be advisable to harvest these crops at a young stage in order to get a lower C:N ratio. I know of the case of a tobacco company that went into the making of compost on a large scale. They purchased large quantities of alfalfa and clover in order to get a good C:N ratio, a rapid decomposition and a high quality compost.

RAINFALL AND TEMPERATURE

As rainfall goes down, the C:N ratio also declines. The higher the rainfall the lower the nitrogen. The C:N ratio of arid soils is always lower than those in regions of higher precipitation. In a soil which had a rainfall of 15 inches per annum the C:N was 13:1. Where it was 10 inches or less of rain the C:N was about 11:1. It has also been found that the higher the temperature the lower the C:N To review: Higher rain—higher C:N. Higher temperature —lower C:N. Also: Higher acidity—higher C:N.

ORGANIC METHOD

Waksman in his book *Humus* states that the carbon-nitrogen ratio of the soil humus remained almost unaffected by the addition of chemical fertilizer nitrogen. The application of organic matter high in nitrogen is necessary for the continuous accumulation of humus. No work has been done on comparative studies of the C:N ratio of organically handled as against chemically handled soils; therefore, I can say very little about the status and effect of the C:N ratio on an organically managed farm or in an organic garden as compared to similar types of places run on the chemical basis. There is room here for future research.

INSTRUCTIONS

Read each question and refer back to the article for its answer. Then read the questions a second time, attempting to give the answers from your mind. In no instance should answers to the questions be mailed to us, nor can we enter into correspondence concerning this course which is primarily intended for the benefit of each reader. Correct your own written answers by comparing with the text of each lesson and mark your work accordingly.

QUESTIONS

1. Explain briefly what is meant by the carbon-nitrogen relationship in organic matter.
2. Why is carbon an important element in healthy plant development?
3. Identify the forms in which carbon is found.
4. Of what importance is nitrogen in soil fertility and plant health?

XUM

5. What is meant by terming a material highly carbonaceous?
6. How would putting a great amount of a material high in its C:N ratio into the soil effect crop yields?
7. In what way does the carbon-nitrogen ratio differ in raw organic matter as compared to that of humus?
8. Compare the carbon-nitrogen ratio of organic matter to that of top and subsoils.
9. Why is the C:N ratio of soil bacteria and fungi always lower than that of the humus in which they work?
10. What is the approximate proportion of protein in nitrogen, and why is this important?
11. Of what value is allowing a sufficient period of time to elapse when plowing under highly carbonaceous organic matter before a crop is planted?
12. Regarding the carbon-nitrogen relationship, what is the value of adding compost to the soil?
13. Name some of the organic materials which have a high nitrogen fertilizing content.
14. How do the nitrification rates of low C:N raw organic materials and humus differ?
15. In what way does the age of the plant material affect the C:N ratio?
16. What are the effects of variations in rainfall and temperature on the C:N ratio?
17. Why does the organic method, through the application of organic matter high in nitrogen offer a more desirable C:N ratio of the soil humus than does the use of chemical fertilizer nitrogen?

REVIEW QUESTIONS

How well have you retained the essentials of Lesson V? Here are a few review questions which have been simplified and are answerable by *True* or *False*. Test yourself (avoid guessing) and then check with the answers on page 43 of this issue.

1. Nitrogen is an extremely important element in farming and gardening, for without it productivity of the soil will decline.
2. An excessive supply of nitrogen will have no detrimental effects on plant growth or welfare.
3. Regarding the desirable supply of nitrogen to a soil, the organic method is superior to the use of chemical fertilizers.
4. Nitrogen is present, either in the soil or in humus, in a free condition.
5. The nitrogen which is present in organic matter is different than the nitrogen in a chemical fertilizer.
6. Many highly concentrated nitrogen fertilizers are toxic in their effect on earthworms and other soil life.
7. Materials high in nitrogen content are extremely important in composting.

Readers are urged to study the concurrent course on "The Soil" in *The Organic Farmer*, Emmaus, Pa., $3.00 a year; $7.00, 3 years.

Author of "Grow Extra Dollars—at Home," Mr. Reynolds here relates his own experiences in gardening under glass.

I wanted a greenhouse

RAY REYNOLDS, N. Y.

A proven formula for combining pleasure and profit . . . any home gardener CAN *enjoy the fun and rewards of a greenhouse*

Photos: John Keller

I wanted a greenhouse. I wanted one ever since as a little fellow it smelled good and it felt good just to be in a greenhouse. But I could not afford one unless it could be made to pay for itself. I knew that with one I

could raise a great many more plants than I needed around the home garden, and it seemed possible that I could sell the surplus. So I decided to take a chance and I put up my little home greenhouse.

Then I went to the library to get books on how to make money with it. Right there I ran into my first difficulty. I found no literature on the subject. There are plenty of books on growing hot house plants for a hobby, on operating a commercial glass range, on gardening, and on farming, but nothing on how to operate a 2 by 4 layout in the backyard for profit. So I proceeded to learn by trial and error. And I made plenty of mistakes. I thought the thing to do would be to raise potted geraniums and ivy but my first customers wanted African violets and philodendron. I then tried to have something of everything and have it in bloom when someone wanted it. The volume of sale, without a roadside stand, was too small to make this worth while.

Next I investigated the possibility of wholesaling to retail florists. When I found that they did a year around business in dish-gardens I filled the greenhouse with an assortment of cacti and succulents. In time they reached salable size and I took a load into town. I ran head-on into mass production. I found that I could not grow under glass and compete with southern competition on plants which can stand the rigors of being shipped overland. I knew that I could not compete with specialists on the big flower holiday items like poinsettias and Easter lilies. Finally, I saw what now seems so evident. I had to raise plants which could not be shipped in from afar either because they needed frequent watering or were too fragile.

Above: Starting annual seeds in the greenhouse propagating bed which is heated by 30 ft. of thermostatically controlled lead cable. As the seedlings begin growth these seed pans are transplanted to seedling flats which can be seen on shelf above the bed.

I would raise inexpensive house plants and sell them locally to the five and dime, supermarket, and roadside stands, to satisfy the impulse buying of housewives. I tried it and the idea clicked immediately. I still had much to learn about just which plants to grow, the correct size pot, and the price to charge. More errors, corrections and adjustments were made but I finally evolved the profitable method of operation.

I have no competition. The head plant buyer of a national syndicate asked me if I could not possibly supply their stores in neighboring towns. I would love to for it would be a little goldmine, but in the time at my disposal it is not profitable to deliver beyond a limited radius, without giving up my regular job to which I commute in the city. On the other hand every town from coast to coast which can support the usual chain stores can support one or more "home growers" like myself.

All you need to start your "home

Left: The author at work in his greenhouse in mid-January claims this fascinating hobby can be a good source of income. Vertical pipes are part of the framework and not for heating. The house is illuminated with lights having opal glass shades.

Reynolds arranges a late winter crop of marigolds on the shelves of an attractively latticed display which he lends to shops as a helpful means of boosting sales.

wholesale nursery" business is: 1—a plot of ground, 2—a propagating bed, 3—a coldframe, and 4—an auto. Having the ground and auto, an investment of about $100 in equipment and supplies plus six to ten hours a week of spare time, puts you in business.

Greenhouses may, in one sense, be put in two general classifications, *i.e.*, those which have ground-level beds and those which have benches. In some instances, greenhouses may have both beds and benches. In the former type, at least a one-inch layer of compost should be rototilled in before planting. It is a good idea to have a soil analysis made so that, if acid, the proper amount of limestone could be added.

In the bench type greenhouse, it is customary to renew the soil annually. It is standard practice to put in a two-inch layer of stone or aggregate before adding the new soil as this allows for drainage. Soil, preferably should be taken from a field in which clover or alfalfa has been grown the previous year. To this, should be added 500 pounds of compost to every ton of soil filled in on the benches.

A little home greenhouse is not only wonderful to have as a hobby, but by extending your growing period around the year, greatly increases your production and earns extra dividends for you on the investment.

This business of growing a succession of different plants at home to satisfy a local demand which is too small to be attractive to the commercial grower is a new development in the florist industry. It has not been reduced to a near science and there is plenty of room for imagination. It pays good returns on the time, effort, and initiative you are willing to put behind it. Whether you plan a very simple, or a more elaborate layout, you can feel that you are making a capital investment which will produce extra dollars for you. You can either:

1—make it pay part or all of the expenses of your gardening hobby, with or without a greenhouse, or

2—build a business of your own, well suited to help keep you mentally and physically fit, and to add to family income and security now and after retirement.

Whether you have a greenhouse for pleasure or profit, or both, you will find a never-ending source of new delights in gardening under glass.

slip your plants

MYRON PARISH, MICH.

August is one of the best times of the year to increase the supply of favorite house plants. If they are started now they will have time to set their roots and become well-established plants by the time they are ready to come into the house for the winter.

A few of the old favorites such as, geraniums, heliotrope, lantana and the ivies, will by now have growth of the best age for making cuttings.

A good cutting is the main factor to proper growth; one good way to tell this is to bend a cutting; if it snaps, then it is in proper condition for good growth. If the cutting is too old it will break off and splinter, if it is too young it will bend without snapping.

A good cutting should be about three inches long. The cut at the base should be slanting, and the foliage of the portion which is to be inserted in the soil should be trimmed off. The foliage above the planting medium, should be thinned out by one-half, to prevent loss of moisture until the roots have formed.

A planting medium of sterilized builder's sand is excellent for starting cuttings, and is easy to obtain. After the cuttings are set in the flats, they should be placed in a cold frame with a lath or cloth covering to give them protection from the hot sun.

When the cuttings have rooted and are ready to pot, a two-inch pot is preferable until the cuttings have grown more roots and new top growth.

SLANT CUT AT BASE

CUTTING PUT TO ROOT IN SAND

ROOTED CUTTINGS PUT IN SMALL POTS.

A good potting mixture consists of three parts garden loam, two parts sand, two parts leaf mold or peat moss. The addition of manure in the potting mixture will give better results when the young plants are being repotted into larger pots.

The Organic World

WARNS DDT ACCUMULATIONS CAN HARM PLANTS

Accumulation of DDT in farm soils may retard plant growth warns Dr. Joseph M. Ginsburg, entomologist with the New Jersey Agricultural Experiment Station, New Brunswick. Research in fields of sandy soil, according to the *Science News Letter* of May 9, 1953, discloses that where an average of 50 pounds per acre had been sprayed over a five-year period, Dr. Ginsburg found from six to twelve pounds of DDT per acre in the top one foot of soil. Concentrations of twelve pounds of DDT, he stated, could be near the danger point for many plants.

EXPERT WARNS NATION'S INSECTS GREATLY INCREASING

Addressing the first annual Pest Control Conference at the Kellogg-Voorhis Campus of California State Polytechnic College in San Dimas, Dr. G. E. Lehker, Purdue University entomologist, warned that insects are taking over the nation. He told 150 state operators at the recent meeting that America is losing the "Battle of the Insects," and cited several reasons. Among these, the specialist stressed the greater international contact and travel which leads to greater introduction of insects from foreign countries; the vast reduction of insect-eating birds and animals; the specialization in industry and agriculture which has resulted in orchards and specialized crops being clumped together in one area; and the fact that the use of chemicals is destroying important predators of insects.

CALIFORNIA FARMERS FAVOR MUNICIPAL COMPOSTING PROGRAMS

In answer to the question, "Will the farmers buy the compost?" which has long been the basis for disputing the value of municipal composting programs along California's citrus belt, farm columnist Tom Cleveland asserts that there are encouraging indications not only that they will, but that many more growers are realizing the importance of organics generally. Writing in the *Santa Barbara News-Press* of January 11, 1953, Cleveland states that the Agricultural Extension Service is recommending application of more bulky organics such as animal manures, alfalfa hay and bean straw; that some of the highest producing groves on the coast have had many tons of bean straw and manure applied to the soil over a period of years; and that some farmers have found that dairying fits in well with vegetable-growing rotation. Organics, he declares, improves the soil tilth, water penetration and water-holding capacity of the soil, as well as being relatively high in phosphorus and potash. He called for full recognition of the serious need for returning to the soil all the organic material we can get.

RECRUIT PREDATOR ARMY TO BATTLE CITRUS PESTS

In a planned biological control effort to destroy hordes of grove-damaging red mites, the Fillmore Citrus Protective District has inaugurated the raising and use of armies of predacious mites. Cooperating with the group's project, reports the *Los Angeles Times* of April 7, 1953, is the California Citrus Experiment Station in Riverside, which revealed that although it was not known until recently that these predators can be beneficial to growers, it has been discovered that they feed on citrus red mites. Efforts are also underway to harvest and ship them to other afflicted areas. Dr. Charles Fleschner of the Experiment Station disclosed further that deposits of DDT and other chemical insecticides on the trees encourage red mites and hinder the effectiveness of employing their natural enemies as a control measure.

FATE OF MAN LINKED TO SURVIVAL OF BEE

By increasingly eradicating the tiny creatures whose functions include the very important one of plant and tree pollination, present-day insecticides and pesticides may well be playing the most villainous role in the fate of all mankind. This, at least, is the contention of several major commercial beekeepers who recently held a national convention of the American Beekeeping Federation in San Jose, California. Reported in the *San Jose Mercury* of January 28, 1953, the nation's apiary leaders emphasized the fact that nut and deciduous fruit trees as well as many other types of crops depend on insect pollination for their continued existence. If the pollinators go, the trees, crops and man's future food supply go with them. The honey bee, since it is protected and cultivated by man, is about the only pollinator left operating in quantity. The increased use of poisonous insecticides, the convention was advised, represents one of the most serious threats to the survival of bees and all other beneficial insects.

MICHIGAN CITY CONTEMPLATES FERTILIZER CONVESION OF GARBAGE

Seeking a solution to a critical garbage disposal problem, the city of East Lansing, Michigan, is considering inauguration of a project which would literally turn household refuse into dollars and cents—as well as valuable organic fertilizer for the community. The system proposed, reports the *Lansing State Journal* of April 1, 1953, would employ a "digester" to convert the raw garbage of this municipality of 10,000 people into a nitrogen-rich, $10-a-ton humus fertilizer. The relatively inexpensive as well as inoffensive process which uses aerobic bacteria and brings about a by-product especially well-suited and safe for home garden use was slated to begin trial operation on May 1st. It was planned as a better disposal means than the unhealthful pig-feeding which it replaces—and adds still another city to the growing list of waste-to-fertilizer proponents.

PLASTIC PLANT FOOD INCORPORATES STRONG CHEMICAL

Claiming numerous advantages over organic fertilizers, as well as distinction from the chemical conglommeration, a relatively new plastic plant food has made its appearance on the gardening market, accompanied by the customary flood of boastful publicity. Investigation, however, reveals the product, Uraform, which stresses the oft-heard slower-dissolving characteristic of many other chemical conditioners, actually contains a very potent chemical. The plasticized plant food is a combination of urea, an organic form of nitrogen, and formaldehyde, a strong preservative commonly used in embalming fluids. Overlooked or ignored, of course, are the detrimental effects of such a chemical on soil life.

Jerusalem artichokes

A nutritious delicacy which could well be more widely planted

MARILYN NEUHAUSER, N. J.

My nomination for the get-to-know vegetable of the year is the Jerusalem artichoke. Usually missing from gardens and seed catalogues, the Jerusalem artichoke bears decorative flowers and produces tasty tubers. Some farms have a stand of this sunflower-like plant growing wild, its nutritious edibility unappreciated.

The Jerusalem artichoke is a native of Canada and northeastern United States where it was cultivated originally by the Indians. It is said to have been taken back to Europe where it is grown extensively in Italy and known as the Carciofo-Archicioffo-Girasole—(Girasole meaning sunflower). The word Girasole is thought to have been Anglicized into Jerusalem (with some slithering). Its use as a good stock food in Europe makes that use worth investigating on farms here.

The Jerusalem artichoke is not to be confused with the globe artichoke, a perennial grown for its eatable buds. The Jerusalem artichoke is hardy, while the Globe artichoke sometimes freezes out before bearing the second year.

High in the carbohydrate, insulin, and in the vitamin thiamine, the Jerusalem artichoke is splendid eating for all, and especially valuable for diabetics. The delicately rich taste is a welcome contribution to diet when home grown foods are hard to get. Cooked, it can be used like potatoes, plain or in soups. Raw, artichokes are refreshing in salads. The raw vegetable is rich in alkaline mineral salts,

The familiar Globe artichoke.

Tubers of the Jerusalem artichoke are very tasty.

Blossom of the Jerusalem artichoke.

particularly potassium. The enzyme inulase which converts starch-like inulint (different than insulin) into levulose, a simple sugar.

The tubers are planted much like potatoes. Unlike potatoes, they are frost-hardy and can be set out in the fall as well as early spring. Fall planting is advocated, but they may also be planted in spring.

Planting may be along a garden edge where shade from the 4-6 foot artichokes will not shadow other plants, or artichokes can be used to beautify those places on the farm where plant screening improves the landscaping.

In choosing a location for planting Jerusalem artichokes, which incidentally are really American Sunflowers and were originally called sun-root by the Indians, the gardener would do well to remember that they spread very rapidly. Unless watched and cultivated carefully they may become weeds. For this reason, they are best given an isolated planting and kept at a distance from choice flowering or other vegetable plants. Remember, too, that the roots must be dug in late fall or early spring and thoroughly removed from the soil if a check is needed against the plants spreading and possibly becoming a weed-like growth.

One medium piece per hill, a foot apart, in three foot rows, is used when row system planting is followed. Some gardeners, planting beds, set the tubers four foot by four foot. Growing Jerusalem artichokes in beds as I did in the southern highlands, the plants multiply rapidly and soon choke out weeds.

Rows may be cultivated or mulched. Better artichoke size is said to be maintained in row plantings. Whether in rows or beds high fertility should be maintained with compost.

I know of no plant easier to grow. Artichokes seem to have few if any enemies. That they are amazingly sturdy is testified by our planting here in central western Jersey. When two foot tall, a friend pulled off the above-ground parts as weeds." Undaunted, the roots put forth sprouts again which attained a height of three feet. Then the horse in an adjoining pasture reached over and devoured the tops. Again new blooms persisted, only to be run down by a truck seeking a short-cut along the fence. Yet in the fall we harvested a nice crop of artichokes, in addition to earlier bouquets of the flowers.

After growth is stopped in autumn by a killing frost, the tops can be cut off and used for compost or as a mulch. As Jerusalem artichokes have tender skins and are not hardy keepers, I dig a supply for a month or two at the most. These tubers need to be kept moist in storage or they will go limp and perhaps rot.

Since frost does not harm the tubers, a supply can be dug from time to time during thaws. Mulch keeps the surface from freezing too hard. In spring Jerusalem artichokes can be dug and eaten like parsnips, none the worse for freezing and perhaps even improved. At this time the remaining artichokes can be dug and replanted in rows, or left in the ground to multiply.

The attractiveness of this retaining wall is greatly enhanced by a wise selection of plant material.

stand your rock garden on end

Garden walls can well be a highlight of lively color and charm in your landscape picture

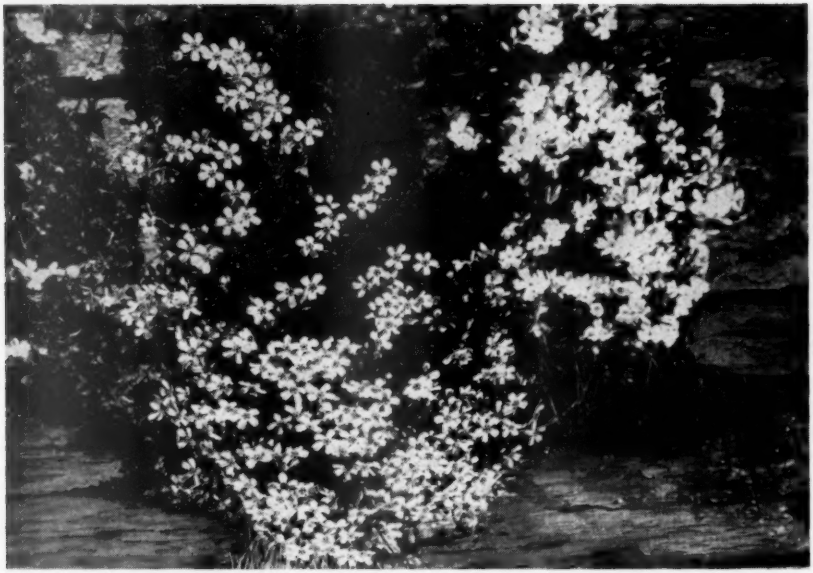
PAUL HADLEY, PA.

If you would like to have a really large rock garden, but have limited space, try this new idea—stand the garden up edgewise, and see how little yard space it takes. Flowering rock walls, such as those illustrated here, are gaining in favor every year as more and more home gardeners realize the advantages of planting such a vertical garden.

Taking up comparatively little space as compared to the more conventional rock gardens, the flowering wall can be made to serve a dual purpose; not only as a rock garden, but also as a retaining or a boundary wall.

The flowering rock wall shown in the accompanying photos is a retaining wall, built against the earthen wall where a steep slope has been leveled off. Six feet in height, the wall is constructed of large stones, set together with a thick layer of earth between them instead of mortar. Many types of small rock garden plants, such as Sweet Alyssum, *Alyssum saxatile,* aubrietias, *Phlox subulata,* and the varioussedyms and sempervivums are used. There are dozens of good varieties of low growing plants, including ferns, which will thrive in such a location if not in too sunny a position.

In making a retaining wall, the

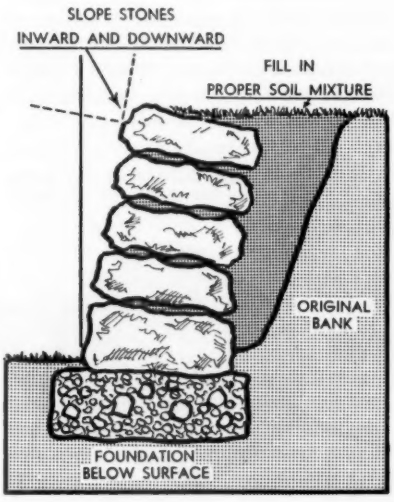


Phlox is well-suited for rock walls having a sunny exposure where their bloom shows to advantage.

stones should be laid so that the face of the wall will have a slight backward slope. In addition to its greater strength and neater appearance, this type of construction will also permit water from rains to soak more readily into the soil between the stones. The soil layer between the stones should be from two to three inches thick, and preferably should consist of a mixture of one-third compost, sand and a good grade of topsoil, to which phosphate rock, basalt rock and potash in the form of greensand or potash rock has been thoroughly incorporated. Such a wall will actually require less water than ordinary gardens, as moisture will evaporate very slowly from between the stones.

The stones used in constructing such a wall should be of fairly large size, and preferably of somewhat irregular shape. This irregularity will permit many pockets of soil in which the roots of the plants may expand. Once established, such a wall garden will endure for many years.

If the wall has a southern exposure, the intense heat of midsummer may cause the loss of some of the more tender plants, unless additional water is given them. Southern exposures make for early blooms, however, and flowers will appear from two to three weeks earlier than when planted on the level ground. In mild climates, may even have blooms all winter.

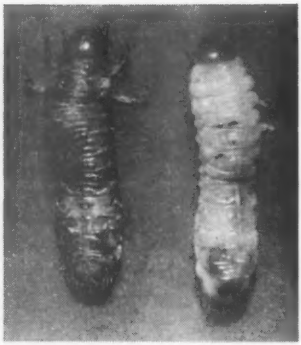


milky spore . . .
a beneficial disease

Adult Japanese Beetle.

The Japanese beetle is now yielding to biological control measures

C. F. CARPENTER



Photos: U. S. Department of Agriculture, Bureau of Entomology & Plant Quarantine

Back in the 1930's adult Japanese beetles abounded, even in our Eastern city streets, and it seemed an almost impossible task to arrest their distribution, yet alone to forestall their depredations. Many growing plants, about 275 kinds, in fact, came in for a share of attention from this voracious feeder. A few, such as the castor-bean (*Ricinus communis*), the great silverbell (*Halesia tetraptera*), the bottlebrush buckeye (*Aesculus parviflora*), and the geranium, were observed to poison some beetles and seemed to point the way for opportunist manufacturers to do a lot of research work in trying to produce an extract which could then be sprayed on other vegetation; perhaps a lot of money was lost in the investigation, for it was without result.

Adult beetles feeding on foliage completely skeletonize the leaves.

Many types of chemical sprays are still used, and unfortunately in our opinion, are applied to produce for human and animal consumption. Research, though, did not develop alone along the lines of quarantine, nor the investigation of spray and dust materials. A fungus disease was discovered on the bodies of some of the Japanese beetle grubs which effectively destroyed them. As a result, the milky spore disease, treated with talc, is now sold commercially and is doing yeoman service in destroying the grubs of this pernicious pest. While the mere statement "treated with talc" may make this sound simple, it is in actual practice, a long, complicated, and highly technical process.

Actually, the disease is caused by any one of several milky diseases. Type A, caused by *Bacillus popilliae*, is the most widespread. The germs are taken in by the grubs during their life in the soil and once in the grub they multiply rapidly until millions of spores are formed. These are able to withstand all conditions of moisture or dryness, and are so rugged that there is no known adverse condition which will kill them off. Once in a soil they'll stay there for years, and even spread to new areas as well.

The blood of the Japanese beetle grub is normally clear in color, but

Left: As the beetle grubs succumb to the disease, their blood, normally clear, turns milky white.

once infected with the milky spore disease, the spores make the blood appear milky, hence the popular name of the disease. As the disease advances (which is actually the rapid multiplication of the spores), the grubs die, but the spores within their bodies remain in the soil. Obviously they are taken up by other grubs in the course of their feeding on plant roots and their general life in the soil, and so the disease spreads its death-dealing punch to all Japanese beetle grubs and those of a few closely-related species. This, in turn, leads to a considerable reduction in the number of beetles which emerge from the pupal

Japanese beetle grubs.

stage and, therefore, a lessening in the number of eggs which are laid.

Early in July, adult Japanese beetles will be seen on the wing from Massachusetts to South Carolina and at scattered points in adjoining states, as well as in the Midwest, east of the Mississippi. So as a pest it is not yet to be removed from the list of formidable insect enemies. Its depredations can be quite severe with whole areas frequently being completely denuded of foliage. Its normal life cycle, too, tended to protect it from natural enemies until the milky spore disease was discovered in affected grubs in 1933 and a method was worked out to make possible the production of milky spore disease on a commercial scale.

The female beetles periodically go into the ground to lay their eggs during July and August. On hatching, the grubs are active root feeders until late May or early June, when they stop feeding and enter into a brief pupal (or resting) stage from which they emerge as adult beetles ready to do their destructive work above ground, destroying crops and ornamentals with equal gluttony and propagating future generations.

Man, however, is beginning to win in this long-drawn out war against Japanese beetles, for although the milky disease works slowly its deadly task to perform, it *is* present in large areas of the affected sections of the country. A very encouraging factor is that once soil has been inoculated, the treatment need never be repeated as the spores lie dormant, yet viable, for many years. Further, as has been pointed out, the disease spores will spread naturally to areas which have never been treated. The disease, too, has no effect on natural enemies of the Japanese beetles, though it will infect and kill grubs closely allied to the Japanese beetle.

Good news, too, is in the fact that the milky disease powder, obtainable commercially, may be applied at any time of the year, and the method of application is quite simple, as well as being harmless to all other forms of life. It should be applied to lawns or other grass areas in spots at regular intervals in rows three feet by five feet; or it may be broadcast. If the former method is used, a level teaspoonful should be applied on the surface, and the first rain or sprinkling will wash it into the soil. The broadcast method is not generally conceded to be as effective as the "spot" treatment, but if used, should be applied either by hand or with a fertilizer distributor at the rate of 10 pounds to the acre. In either case, it is recommended that the quantity of milky disease powder

(Continued on page 49)

rhubarb . . . the pie-plant

Plant the makin's for a whole season of delicious oven-treats by getting this easy-to-grow herb into your home garden

MARGARET CHAPIN, DEL.

"There is enough rhubarb ready to pick to make a pie!"

The day on which this point of development is reached in the garden, is a red-letter one for the family. The succulent stems of the rhubarb are red, too—rosy red, when the favored person delegated to gather them, pulls away the largest of the stalks growing on the outside of the plant. In short, it seems as if no garden is complete without its bed of rhubarb.

As to the care of this delectable pie-plant, the first thing to remember is that it is one of the hungriest of vegetables. Any discouraging results in growing it are largely due to a lack of proper food.

Rhubarb is not choosy about its soil. It will grow in almost any type, provided that it is well-drained and generously supplied with organic materials. A soil having a pH range from 5.5 to 7 is recommended. Preparation of the site where it is to be planted, consists of fertilizing the space with compost in the proportion of about one bushel to every square foot of earth. This is worked thoroughly into the soil; then at planting time, manure is dug into the hills or rows allotted to the plants.

This vegetable is propagated in two ways: by division of roots and by seed, the former method being the quicker and wiser one. Rhubarb grown in home gardens will not produce seedlings like the parent plants. Special crops for seeds are grown by experts; so if you choose this method, be sure to obtain your seeds from a reliable source. These are sown in the spring, in rows set eighteen inches apart. As soon as the seedlings are large enough to move, thin them so that they stand from seven to twelve inches apart, then allow them to develop during that first summer, and the following spring transplant them to their permanent place in the garden.

Division of rhubarb roots may be made either in the early spring or in the fall, from the middle of August on through the first week of October. Cut the old root into pieces which have two or three buds at the top. Space the cuttings from three to four feet apart in the row, setting the crowns about four inches deep, or so that they will be covered with three inches of soil. Water well. After pressing the earth firmly around the roots, leave the new rhubarb bed undisturbed until cold weather comes. Following this, after the ground is frozen, either cover the earth around the plants with strawy manure, or make small hills around the cuttings and give each one a light mulch of compost or manure.

This initial feeding will not be enough however. Rhubarb will need fresh nourishment every year which may be supplied by mulching with compost or manure.

And, be vigilant in curbing your natural impatience to pick those young stalks as they develop. No leaf stems should be taken from rhubarb during their first year of growth, and

Since it thrives in a wide variety of soils and geographic localities, rhubarb, as seen here, is a good choice for garden or field.

only a few during the second year. It is only with the arrival of its third season that the cutting of pie-plant begins.

This royal season will last for only about two months. At its end, little remains to be done in the way of care for the plants except to thin the smaller stems which may have sprouted, and cut off all seed stalks as they appear. These two tasks are necessary to help conserve the energy of the plants and leave them free to give undivided vitality to the great leaves. Be sure to let these last spread as they will. A good crop of rhubarb in any year depends to a large extent upon the strong leaf growth of the year before.

While fields of rhubarb are grown commercially in the New England and some of the Western states, the beloved pie-plant is one of the most popular vegetables in home gardens the world over. Its one drawback seems to be that the season for fresh rhubarb is so short. If, however, you are willing to add a few extra tasks to your fall work in the garden, you may bring the process of the commercial *forcing* of rhubarb on a large industrial scale to your home tract. For by bringing some two year old clumps into the house at this time, you may have freshly grown pie-plant in the dead of winter.

The plants should not be moved until their tops have been killed by the frost. This will probably be by the first of November. Then dig up the roots, leaving plenty of soil on them, and let them lie on the ground exposed to cold nights and frosts until they themselves are thoroughly frozen. Then plant them in boxes and place them in a cellar or room where the temperature may be kept at about fifty degrees. A time-saving alternative would be to plant the roots directly in boxes as soon as they are dug, and leave them in the open until the ground in them has frozen hard. Keep the soil in the boxes moist but not extremely wet, and about the first week in January you will see small leaves appearing—leaves which will soon be held aloft on a crop of young, tender, rhubarb stems.

Even though your plants are strong, healthy and thus resistant, there is one insect which may cause trouble in your bed of rhubarb. This is the rusty snout beetle, which is fortunately three-fourths of an inch long and so is large enough to be seen and picked off by hand. In addition to rhubarb, this insect feeds largely on wild dock, so if there is any of this near your garden, be sure to destroy it, waiting until after the middle of July to do this, since by that time the eggs of the beetles will have been laid among the dock leaves, and can thereby be simultaneously eliminated. Contrary to the usual jest, the rain won't hurt *your* rhubarb—if it is given planned organic care. Include this tasty choice in your garden program—and get the pie plates ready, Mom!

berries for profit

Make any sized garden a really fruitful one

J. O. WARNER, VERMONT

The most extensive experience we ever had in farming entirely without chemical fertilizers was when we took over a small hillside farm in Connecticut. We had only recently come from Florida, and our idea was to start a little berry farm and go into the berry business.

We wanted to grow our own currants especially, as they were the most expensive to buy, and sometimes difficult to find at any price. One year we had to send as far as Highland, N. Y., for them. And as 90 per cent of our orders were for currant jelly, we wanted to make sure of a good planting of several varieties of red currants and also of grapes, raspberries, blackberries, and strawberries.

We wanted to find just the right location, so we spent most of one summer, odd times, looking about. We finally located a small place of several acres. The house didn't amount to much; but can always be patched, or remodeled, if the location is right. Most important, the price was within our means; also the place was empty, and we could take possession at any time. This suited us fine, as we wanted to move the first week of September, in order to get our fruit bushes well started before frost, and freezing weather came.

The place was a little way inland from Milford. It was light soil and rather stony, and decidedly up-and-down in spots, with nothing level about it. Still, there was no erosion. The cobbly condition of the soil probably attended to that. We had made arrangement for our currant bushes to be delivered a few days after we moved out there. We had chosen them from good healthy stock at a nearby farm where we had been buying the fruit for several years. Indeed, the quality of this man's fruit in general was what had induced us to look around in the same vicinity to try to locate a small place near his farm.

In an earlier talk with this neighbor, he had disclosed to us that when he first moved out to his place, he was disappointed and discouraged at the condition the land was in. He had bought it in midwinter, when the fields were covered completely with snow—certainly a poor time of year to buy farm land anywhere. But he went on to say that by plowing under what available waste roughage, cornstalks, leaves, in fact everything he could rake up, and scattering it on the land, along with scraping out the old barnyard, he made a very fair crop, even that first year. Well, his talk encouraged us to

feel we might do as well with our own worn-out land. So with our neighbor's help to decide the best place to plant each variety of fruit, we started. Planting out the strawberries and raspberries on the lowest levels, we left the stony hillside for the young currant bushes, and a good sized planting of Eldorado blackberries, the variety that really stays black after they are picked. We felt that a nearby city would take all we could raise of those and of the strawberries, while our other fruit was coming along. Well, we followed our neighbor's example in scraping up all refuse for the land, hoarding all the maple and oak leaves that fell, and making compost heaps, one close to the kitchen door, to catch all the waste from the house. It is surprising how much accumulates even through the winter. On a good dry day we raked, and filled the old hen-house full of leaves for the hens to work over, stacking up a few bags of leaves to use later on in the winter. How those hens did appreciate that little attention. We had noticed that when hens are let out during warm spells through the winter when the ground is generally bare, they will hunt for the deep gulleys and ditches, wherever leaves accumulate, and hunt and scratch, till they have turned and looked under each individual leaf. So, having leaves already stacked in their houses would help to keep them interested even when snowed in. Then, what a help to the land these same leaves are when taken out in the spring and worked into the ground around the fruit bushes! Nothing was overlooked or wasted that would help to make mulch.

Photo: Frova

Strawberries were very prolific and proved a good source of income.

A good-sized planting of Eldorado blackberries which also had the customers coming back for more.

Photo: Black Star

And we knew that fruit grown by chemicals alone did not have either good rich flavor or coloring. It took a couple of years to get good strong plants and bushes started, but we felt their roots had something substantial to grow on to help make bumper crops in a few years. And it was surprising how quickly they grew when the roots did get a toehold, and the deep green of the leaves showed there was potash already, even from the short time we had been turning under leaves and compost. Well, we felt we were on the right track when even the third year of our experiment could show great clusters of red currants on good stocky bushes. The Latham and Cuthbert raspberries were wonderful, too. These bushes were planted quite close to the road, the land along there being more suitable for them. And very little of that fruit were we able

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to reserve for jelly making, as customers were waiting as fast as the berries ripened. It was the same way with the strawberries. As the buyers expressed it, "Your fruit seems to have more flavor than what we buy in the city."

At one end of our Milford farm there was a stony little pasture, the land really too poor and worn out to even think of putting a cow in there. So after our fruit was well started, we gave that little worn out pasture our whole attention

We sure were able to get that pasture plowed up that fall and sowed to rye, also the old reliable Cowhorn turnipseed to help get humus into the soil. The weather being mild that fall, the rye got a good start, and by late spring was stocky enough to warrant letting the cow on it for a couple of hours each day. As the ground had thawed and loosened up toward spring, we sowed alfalfa and clover seed. When that pasture kept a good deep green color in midsummer, in spite of the cow browsing on it a few hours each day, we felt we had made a good start to bring it back to a healthy growth.

Of course, when it was plowed in the fall we had scattered lime all over the field before it was harrowed, as there was a deficiency of lime. By adding wood ashes as we can, we hope to bring in a good stand of clover in a year or so. And by saving all the leaves we can scrape up, making compost of them to work into the land we feel we have built up a successful little fruit farm, entirely of humus and without the aid of a particle of commercial fertilizer.

The Soil and Health Foundation

The 20th century has been an era of almost incredible advancement in practically every aspect of life and every phase of human betterment. These advancements, vast and diverse as they are, bear one very important common feature: they are all the result of careful study, of tireless investigation, relentless research and experimenting. No such extensive and life-encompassing improvements could possibly have evolved without this planned and persistent work; civilization would know nothing of progress were everyone merely to sit back and wait for it. On the contrary, we would plunge increasingly deeper into the abyss of retrogression, into the depths of self-satisfaction, waste and degeneration.

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Send your planned contribution today to:

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Dept. O.G., Emmaus, Pennsylvania

answers to review questions

(See page 31 Course in Organics)

1. True. High productivity is interrelated with the supply of organic matter in a soil, the yearly application of reasonable amounts of which will assure the farmer of adequate nitrogen. Nitrogen is necessary to the functioning of every cell of the plant, and is directly responsible for the vegetative growth of plants above ground.

2. False. An excessive supply of nitrogen will not only retard the growth period, but will also reduce the plant's resistance to disease and produce an inferior quality of crop, which will have poor keeping and shipping abilities.

3. True. The organic matter, unless a tremendous excess is applied, gradually feeds the nitrogen to the plants as required. Organic matter decays slowly, thus not releasing the nitrogen too quickly. With chemical fertilizers, a too enthusiastic hand may readily give the soil an oversupply.

4. False. If nitrogen were present in a free condition, it would be rapidly decomposed by soil organisms and much of it become lost to growing crops. It is present in humus in the form of protein compounds which are highly resistant to microbial dissolution, thus releasing its nitrogen slowly.

5. False. As an element, nitrogen is always nitrogen. There is no such thing as a synthetic nitrogen. However, protein, which is the compound in which the nitrogen is present, consists of as many as six elements, of which there are possible billions of different combinations of varying proportions.

6. True. It is probably not the nitrogen which has this harmful effect, but rather a carrier for the nitrogen, like cyanamid, often found in chemical fertilizers. These toxic substances are not only *not* needed by plants, but remain and accumulate in the soil, to its detriment.

7. True. Since the nitrogen (protein) is the principle food of the bacteria which engage in the decay processes, when the raw materials of composting include highly nitrogenous organic matter, such as hen manure and alfalfa hay, the composting is accelerated and the quality of the compost better.

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high altitude gardens

(Continued from page 18)

trol successfully by means of seeking them out at night with a flashlight.

Preparations for next season's garden include the planting of many earthworms in addition to filling her newly built bins which are four by four feet in width and three and one-half feet high, made with two by fours for the corners, six inch siding and one-half inch space between the siding for air space. Her battle with the soil has been won by natural techniques. Hail storms which occur suddenly do no permanent damage to the strong well-nutured growth of her plants.

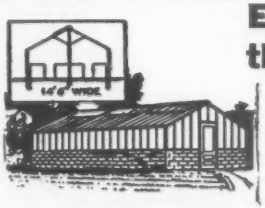
Mrs. Princell's lovely ranch style home is decorated with wispy flowing ferns and plants which are suspended from wire racks or pottery dishes. Her pet indoor plant is the amaryllis, which she at first despaired of coaxing into more than four leaves per plant. After removing one inch of soil from the top however, and placing pure compost material in its stead, she has grown twelve leaves per plant with blooms eight inches across.

The winner of many trophies as a golfer and bowler, Mrs. Princell finds the study of organic garden methods taking a larger and larger share of her interest and tells of her hopes for more land where she can become an Organic Farmer, with her husband's help, of course.

A few tips which she is passing along to other high altitude gardeners confronted with similar problems are:

1. Do not plant too early, preferably during May. 2. Do compost heavily and use winter mulch. 3. Use stakes for tall plants to protect from strong wind. 4. Do not dig composted soil too deeply. 5. Secure winter mulch with tree branches. 6. Use the winter months for experimenting with indoor plants and adding to your knowledge of new garden practices.

A saying among mountaineers is, "It's funny how the people on the low land look down on the folks on the mountain-top." But Mrs. Princell has proof that the loveliest flowers sometimes grow closest to the sun.



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garden hints

weeds as good mulches

I used to pull weeds, gather them up in baskets and throw them on the compost pile. Showing my patch to a friend after a five day rain I said I was sorry he saw it when it was so very weedy. "I don't mind weeds," he remarked, "they make a good mulch when properly laid down." Finally, I took the hint and tried it, but there was a shower that night and the next day the weeds were standing almost upright and doing very well!

What was that about having them properly laid down? After learning by trial and error I discovered the rule: When moving forward to weed, lay the weed-roots toward the back of the row; when moving backward, lay them toward the front of the row. Results: Roots are always on top of the weed mulch and exposed to the sun; no weeds are placed on top of the roots to bury them; they have no contact with soil; they cannot re-root.

protecting tree trunks

When you plant fruit trees this fall pour an inch thick layer of small stones or gravel around the base (coarse limestone is excellent). Being careful not to injure the tree, slip two drain tile over it. Then pour a few more stones, enough for an inch layer, inside the tile and you will have a guard to protect against girdling by mice and rabbits. Put your mulch around this and it will not damage the trunk. The tile must be broken and removed when tree gets too big.

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See page 1 for news of Hoover's new, all-natural Soil Conditioner Blend now available from your Hoover dealer.

forgotten flowers:

the Fritillaria

A graceful family of unusually colorful, bell-shaped flowers beckons from the past to add a special charm in today's garden

LEONORA SILL ASHTON, DEL.

Mention of the fritillaria brings to my mind a well-remembered picture of a partially shaded corner in the April garden where a group of stately plants about twelve inches tall held up their crests of drooping, bell-shaped flowers. These, I recall, were greenish-white in color, gayly checkered with purple spots. "Snake's Head Lilies" their owner called them. In reality, those enchanting flowers were *Fritillaria meleagris,* one of the many members of the large intriguing family called by this name.

The word itself stems from the Latin *Fritillus,* which literally means checkerboard or dicebox, and refers quite accurately and descriptively to the petals of the blossoms which are often checked or spotted.

The fritillaria are widely distrbuted over the north temperate zone, and just as widely—in our own country, at least-referred to as "novelties" in the flower world. This term is inappropriate, for in years gone by, the *F. imperialis,* or Crown Imperial, was one of the characteristic mainstays in old-fashioned American gardens. It suffered banishment from these only when home gardeners became too fastidious about the odor of this species, which resembled somewhat that of skunk cabbage. This was an unfortunate dismissal, for this graceful plant—not unlike many others which possess pungent aromas—lent to a profound, yet delicate note of colorful attraction to our flower borders, and with its fine splash of purple and other hues should again find its place in the shady corner of our gardens.

Today, this entire flower family holds out an almost endless realm of interest and experimentation for home gardeners as well as horticulturists. Between seventy and eighty varieties of fritillaria have been classified in our own country and Europe. In California, Alaska, England, Norway, Palestine, Armenia, Turkistan, the Pyrenees, the Caucasus and even regions of Siberia, members of the genus flourish, each with varying characteristics of form and color which mark them as coming from different lands. The checkered lily, which grows wild in the moist meadows of England, was probably brought here by some of our early settlers. At any rate, this species is an ideal plant for naturalization.

The fritillaria which are native to

this country are confined to regions along the Pacific coast. While purple, wine-color, and browns, distinguish many of the scattered specimens, the brighter colors are also to be found among them, – the reds and the yellows.

Seeming to ignore the general craving of the family for shade, some of these native specimens grow in full sun, in open fields, and in heavy, clayey soils. Contrastingly, others blossom here in woods and under leafy trees. These observations alone, show what a vast opportunity for experimentation in the cultivation of fritillaria is to be found. One fact will lend appeal to all gardeners: With the exception of some rare specimens and certain of the dwarf varieties, all fritillaria will grow successfully in the home garden. Even with those difficult in cultivation, study, watchfulness and perseverance will have their rewards.

For instance, it may be found that some of the lesser known specimens will prefer an evergreen carpet through which they may push their way. Others, requiring the properties approximating the native wild state from which they came, will need leaf mold in the soil before they will grow.

Our own native or California species of fritillaria have been divided into two groups. Both of these are grown from bulbs which resemble those of the lily with its scaly outer coverings; while nearly all the species from the old world spring from bulbs which are tunicated, or wrapped in a hairy or wooly tunic, like those of tulips.

The first group of the American family have thick, heavy scales on their bulbs, which in turn are attached to a thin, rhyzome base. The second group have low-standing, conical shaped bulbs whose sides are covered with small offsets, so much like grains of rice in shape that they have earned the plants the name of rice-root fritillaria. The stems of these last are very slender, but grow to a greater height than those of the first in that they stand from one to three feet tall. Like those of the first group, they are leafy at the base.

While the greater number of the fritillaria should be shielded from the noonday sun, this first or rhyzome group of native specimens requires only a light shade above them in the garden. Accustomed as they were originally to open fields, they need the extra light for drawing out their stems and prolonging the bloom of the flowers.

As for the rice-root group, give these the most sheltered spot in the garden you can find, with plenty of shade above and around it, and plant the

Photos: Edgar T. Clewell

One of the varied and delicate fritillaria which lend such bright, proud liveliness in any garden.

bulbs in a loose, light soil, rich in compost.

Crown Imperial is the most vigorous and robust of all the fritillaria. It requires planting in deep, richly-composted soil, and to be given much room in which to expand. The generous amount of compost used here, that is, two-thirds compost to one third part of good garden soil, is worked in the soil a full six inches below the space where the bulbs are to be set.

For this medium-sized fritillaria, place the bulbs on a level, six inches from the surface of the ground; but remember that the taller varieties need to be planted only from three to four inches deep, while the dwarf species should be set only one and a half or two inches deep.

The culture of these plants is variable. Some are naturalized; some are grown in borders; others, in rock gardens; still others, in pots. It is a universal trait of the members of this voluminous family to increase rapidly by means of offsets forming from the bulbs of one kind or another. For this reason, all fritillaria—the rice-root group above all—should be taken up from the earth, divided and transplanted at least every three years. If this is not done faithfully and sytematically, the small bulbs will rob the larger ones of strength and growth, to the detriment of all concerned.

The great majority of these plants will grow most successfully when they are shielded from the midday sun. They are essentially growths of the north temperate zone, with a strong leaning towards the north. We have heard them described as a "genus of arctic bulbous plants," and it has been discovered that a southern exposure has in every case shortened the lives of the flowers, as well as caused them to be smaller in growth than they would otherwise have been.

A good general formula for planting fritillaria is to place the bulbs in a spot which is shaded but not too cold, and in well-drained soil. The soil should be neutral to slightly acid, the plant requiring a pH of 6 to 7.5. Remember that, almost without exception, they require wide spacing and deep planting in exceedingly rich soil. Ideal planting time varies with clime and locality. Where winters are quite mild, plant the bulbs in the early fall, the latter part of September or first week in October—the former period being preferable if one is planting in a border. Generally, early spring or midsummer are suitable in other sectors.

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It is always interesting to try new flowers in our home garden borders and beds. The presence of the little lily-like blossoms of this varied genus will add fresh interest and beauty to the scene with every species we may choose to cultivate.

A wide choice lies before us. One might well be, Moggridge, a great favorite already with home gardeners. This sends forth gleaming yellow flowers with petals checkered inside with bright red or reddish brown. There is the Black Lily of Alaska, which has a pure livid. wine-purple color, and is uncheckered. It is included in the masses of F. *camtschatcensis* which grow in that northern region, and form one summer attraction for tourists in that country. Another black species is the Chocolate Lily of Southern California. This has a deep, chocolate-brown color. Whatever the color combination, however, all fritillaria have their own special charm and can well fill your garden corner or border with graceful appeal.

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milky spore

(*Continued from page* 35)

be first thoroughly mixed with several times its weight of sand or topsoil.

Federal and state agencies, up to the end of the 1950 season, applied more than 166,000 pounds of the spore dust at nearly 122,000 colony sites,* treating approximately 93,000 acres in fourteen eastern states and the District of Columbia, and there was a marked decrease in incidence as the direct result of these treatments.

Concerted action by residents in areas affected by the Japanese beetle will help greatly to bring this voracious plant feeder under control, and in the interim it will materially assist in ridding your own grounds of the grubs, forerunners of generations of Japanese beetles.

**U. S. Department of Agriculture Yearbook, 1952.*

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tricks for summer planting

With adequate organic matter in the soil, and proper mulching summer planting is practical in the Southwest

The following is condensed from *Sun-Up Magazine*.

This summer, thousands of proud new homeowners will move into wonderously spic and span dwellings—surrounded by bare dirt. Chances are that 99.9 per cent—maybe only 99.7 per cent—will not feel "moved in" until they begin to see the bare dirt masked by lawn, flower beds materialize, and the sharp lines of houses and garage become fluid shrubbery. How can landscaping be started in the midst of our extremely hot summers? Here's an answer:

In our milder "St. Augustine regions" folks can get their lawns underway by setting out sods or stolons if, as most do, they prefer St. Augustine to Bermuda, which too often proves itself a pest. A select group of heat-resistant annuals can be planted right through the hot weather. Generally, it's best to secure plants, if you can find them, rather than start them from seed.

Shrubs or "ornamentals" are the victims of tradition when it comes to summer planting. Deciduous (leaf-losing) ornamentals present our largest and severest problem for year-around transplanting. But rose bushes can be successfully transplanted at any season if they have been grown for a short period in containers such as gallon or larger cans, clay or composition pots or have been balled and burlapped. Remove the rose from its container, take care not to break the cylinder of earth about the roots. At

planting, it is desirable to remove the young, small, tender leaves on terminals of branches, place good soil around the plant and soak thoroughly with water.

Other deciduous shrubs, plants or vines also can be transplanted if grown in containers or are in a "cured" condition. "Cured" or "hardened" plants have been healed in, then balled and burlapped while dormant, then left in soil either in container or ball of earth.

After years of research evergreen and coniferous shrubs can be safely planted approximately 12 months during the year. Many of the broadleaf evergreens also transplant well. They include the waxleaf ligustrum, privets, abelias, gardenias, azaleas and many others. But they, too, must have gone through a hardening or curing period in the nursery.

It is neecssary that after plants are in their desired locations, they be properly and regularly watered, soaking the soil around roots thoroughly. After soil is thoroughly moist, spray fine mist over leaves either late in the evening or in early morning for about two weeks after transplanting. This keeps the plant's moisture from evaporating too fast in excessive heat.

It often pays to place a burlap or light-sacking shelter around the new plants. Before doing your planting, water the area thoroughly about a week previously. If the ground is very dry, water again two or three days previously. The soil should be easy to work in.

The summer is an excellent time to lay your plans for permanent planting. Also, it's an excellent time to build your trellises and fences and get your place in order for the best planting seasons—autumn and spring. But if you wish to go ahead—as most of us do—and get your place "looking beautiful," observe proper precautions and get busy. Summer's hot weather is no insurmountable obstacle any more.

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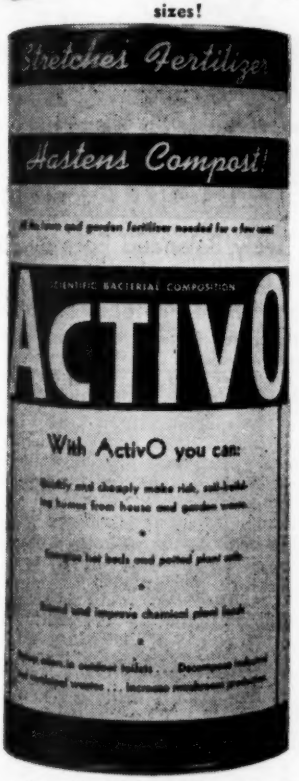

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BOOK REVIEWS

Gardening Indoors as a Hobby by William Ruben. 64 pages, illustrated, indexed, Plant Specialties Co., Box 352 Asbury Park, N. J. $1.00.

This small book is a perfect goldmine of information on the proper method of growing a wide variety of house plants. First, potting soil is thoroughly discussed. Cultivation, ventilation and humidity are separately treated. Pinching, pruning, resting, summer care and plant propagation are dealt with in such a complete and concise manner that the veriest amateur is bound to have success if the rules are followed. Two hundred and forty-five foliage, bulbous and flowering plants are listed with information as to their preference, regarding sun, shade, moisture, and general treatment. There is also a very useful list of sources of unusual plants for those enthusiasts who wish to try the more exotic varieties. The reader will have to follow his own ideas though in regard to fertilizers and spray materials where the author's recommendation diverge from those usually practiced by organiculturists.

Grow Extra Dollars—At Home by Ray Reynolds. 51 pages, illustrated, indexed. Ray Reynolds, Armonk, New York. $2.00.

The author, a practical greenhouse operator, has written an informative volume of his experiences that will save the average gardener from the usual pitfalls of building, starting and maintaining a greenhouse. His book, too, is replete with practical suggestions on how to make gardening un-

der glass profitable—for by his energy, initiative and drive, he has worked up a nice garden nursery business. The first chapter deals with equipment, which includes coldframes, propagating beds, potting room, flats and flower pots. The second, discusses the how and why of planning and production so that crops are available at times when prices are normally high, and a timetable showing when and what to plant, makes this a very complete chapter. Tubers, annuals, seedlings, cuttings, bulbs and seeds are detailed in such a manner that one has all the advantage of the author's know-how before actually starting to market the products of one's labors. The fourth and final chapter deals quite logically with marketing and such factors as pricing, wholesale and retail discounts, trade names, stationery and records. If one can't make dollars grow after reading this small volume, one simply doesn't have a "green thumb" or any ability in plant raising at all. Whether one operates a greenhouse as a hobby or intends to make a business out of it, there is much in this small volume to make it valuable to anyone.

400 Plants of South Florida by Julia F. Morton and R. Bruce Ledin. 134 pages, illustrated, indexed. Text House (Florida) Inc. $3.50.

The authors, acknowledged authorities in their fields, have done a remarkably nice piece of work in selecting, classifying, and describing many of the plants common to gardens in the area covered by this book. Its concise information is an aid to the plant enthusiast in identifying plants with which he is unfamiliar.

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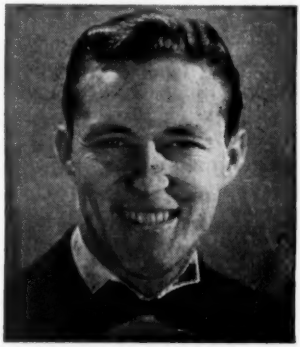

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August

the north

• Start compost heap with weed cuttings, grass clippings and, when harvested, string bean vines and corn stalks, as well as beet and carrot tops. Soak well with water and apply an activator.

• Prevent weeds from going to seed by keeping the weeds cut.

• Add additional mulches, especially to early potatoes to prevent those turning green that are near the surface. Also apply to tomatoes to keep the fruit from touching the ground.

• Pick sweet corn early in morning before hot sun. Can or freeze within a few hours if possible. Try eating the corn raw: it's delicious!

• Plant late turnip seed, spinach, lettuce, beets and radishes.

• Do summer pruning on fruit trees by cutting out water sprouts and eliminating branches which have poor shape and poorly colored fruit.

• Mulch fruit trees with spoiled hay and grass clippings. Keep mulch from one to two feet away from trunk of tree to discourage mice. Put a circle of finely crushed stone a foot wide around tree trunks as an additional precaution.

• Cut lawns higher, preferably an inch and a half, during hot weather to prevent transpiration of moisture by the grass.

• Give thought to dividing iris clumps where they are too thick. Dig up, divide and transplant the rhizomes one foot apart in new beds.

• Take cuttings from English ivy to make good house plants.

• Take cuttings from prize rose bushes and start them to root in the shade in a mixture of equal parts of sand and peat moss.

• Disbud dahlias and chrysanthemums to one for larger bloom.

the northwest

Eleanor McConnell, Oregon

• August is a good month for gardens and for gardeners. Get outdoors, in the sun or shade, as you prefer, and enjoy the fruits of the work you have done.

• Keep building on that compost heap. In addition to manufacturing a supply of treasured compost, it is a convenient place to get rid of all unsightly material from the yard and garden such as dead weeds, leaves, light prunings, etc.

• Apple windfalls (if easily available) can be laid on the ground as a mulch for blueberries and broadleafed evergreens. The fermentation will help to maintain an acid condition in the soil.

• August is a dry month in the northwest. With a deep mulch, the ground will stay moist. If the ground has dried out, use a soil-soaker, irrigation ditches between rows, or some method of letting the water get into the ground very slowly. Otherwise the water may run off.

• Remember about phlox for color in late summer. Colors range from white through all the pinks and roses to purple. Transplanting while blooming doesn't seem to set them back, so rearrange then for a pleasing color scheme.

• Bud-drop on fuchsias and tuberous begonias can be the result of dryness. There must be plenty of humus to hold the moisture and the plant food. Feed frequently during the summer with liquid manure or fish emulsion.

• Chrysanthemums need food while their buds are forming. Feed every two weeks with liquid fish emulsion.

• All perennials which have finished blooming can be divided.

• Early-planted glads might be ready to dig, if their foliage has died down. Keep feeding the glads which are just coming into bloom.

• Harvest onions if the tops have wilted. Let them lay on the ground for a day or two, if desired. Then place them on garage or attic floor to dry. They can also hang in bunches with the tops braided.

• Plant seed of asparagus in seed bed. Set out when large enough to handle.

• Harvest vegetables properly for good eating: Melons are ready when they come off with a half twist; corn, when milk has risen in kernels; peas should fill pods, but don't wait for outline to show on outside; salad greens and berries should be picked in cool of the morning; cabbage can be kept from splitting by chopping the roots on three sides with a sharp spade.

• When strawberries are through bearing the patch can be cleaned up. Old plants can be thinned out if runners are taking hold. Feed the patch generously now with both compost and phosphate and potash rock to give plants a good start for next year.

• Cut your lawn high (1½ to 2 inches) and cut it only as needed. Hot August sun bakes the bare roots. Loosen such spots with a spiker or rake, soak them well and top-dress with compost.

the south

Brent Senay, Georgia

• Bush, snap and butterbeans, pole snapbeans, sweet corn, cucumbers, squash and tomatoes may still be planted in nearly all parts of the South.

• There are many frost-hardy vegetables to put in now. They are: beets, carrots, cabbage, collards, lettuce, Swiss chard, Chinese cabbage, rape, spinach, onions, turnips, mustard, parsley and kale.

• Hard coated seed such as beets and Swiss chard should be soaked over night before planting. Freeze lettuce seed in refrigerator tray before planting.

• Sow fall head lettuce in a semi-shady place and transplant when large enough, in coldframe; may be set in the open in the Lower South.

• Plant Fall Irish potatoes in a freshly opened furrow early in the morning or late in the afternoon. Cover five to seven inches deep.

• Plants that have foliage streaked with yellow and that are not growing or blooming as they should are probably suffering from a deficiency of potash. For quickest results apply wood ashes, preferably from hardwood trees. Then for permanent correction of the deficiency apply a generous helping of potash rock.

• Water flowers deeply during dry spells. Spray foliage of camellias every night during hot weather, being sure to reach the underside of the leaves.

• Spray with strong stream from the hose, evergreens and perennials that are rusty from the sucking of red spiders, especially ageratum, phlox and delphinium.

• Feed and water roses toward the end of the month.

• August is the best month to divide candytuft or plant candytuft seed.

• Lift and divide Siberian, Dutch and Louisiana iris.

• Take cuttings of true dwarf boxwood. They require plenty of moisture and a shady location. Sand or sand and peatmoss are good rooting mediums.

• Layer flowering trees that reach down to the ground. Also take cuttings from deciduous shrubs and broadleaved evergreens; American holly, Japanese magnolia, blueberry, etc.

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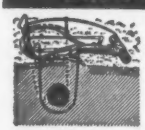

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• Liquid manure is an efficient way to feed plants. Use one pound dried manure or two pounds regular stable product to one gallon of water. Let stand a week and then dilute, to the color of weak tea—one part solution to five parts water. Apply to roots of plants.

• Sow pansies and sweet peas for winter flowering; also portulaca and sweet alyssum in bare spots for quick ground cover.

• Combine liriope and fragrant plantain lily (*Hosta plantagirea*) to flower this month in the shade.

• Order bulbs this month for Spring blossoms.

the southwest

Charlotte M. Hoak, California

• Make every effort to conserve moisture and build up the humus content of your soil. Mulch and dry compost continually.

• A patented deep waterer and a length or two of soil-soaker hose are the best investment for general irrigation, and some good foggers are effective for keeping your seedbeds from drying out and increasing the humidity for your acid loving plants.

• By the middle or last of the month start your winter vegetables in your seedbeds for early September planting. The different cabbages and cauliflowers, Italian broccoli, Bermuda onions, Fordhook chard, parsley and winter lettuce are all good varieties. At the same time start the winter blooming annuals, stocks, tetra-snapdragons and calendulas. If you are experienced, try pansies and violas.

• In many areas the fall crop of Irish potatoes can be planted in thoroughly irrigated rows. Apply compost before planting.

• Late planted tomatoes give best

results. Use beefsteak and yellow Jubilee. Prolific Marzano makes fine salads and the best Italian paste.

- Last call for planting winter squash. Try delicious Uconn or handsome Turk's Turban.
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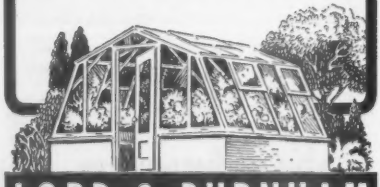

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growth "yardstick" for tastier vegetables

Tastier frozen vegetables could be available if farmers followed a new growing "yardstick" announced by C. W. Thornthwaite of Seabrook Farms, Inc., Bridgeton, N. J., in a report to the Operations Research Society of America. The vegetables would always be picked and processed on the day they just ripen.

A pea plant is used as a yardstick for the planting and harvesting program. The growth rate of other plants —sweet corn, snap beans, lima beans or spinach, for instance—is tied to that of peas.

The pea plant was chosen as a yardstick because it grows from one growing point alone, that is, it comes up and forms a node, grows from this to form another node, etc. The nodes develop at a high rate in summer, and at slower rates in the early spring and late fall. Using the average of several years, this node development is translated into "growth units."

Seeds of the desired crop are planted according to the "growth unit days" that should lapse before the harvesting time most appropriate for the best use of available manpower and harvesting and processing equipment. To get, for instance, 15-acre plots of peas just ripe for harvesting one plot daily, one field would be planted on March 5, the neighboring field on March 9. Planting season can be shortened by using slower-growing varieties for the late harvest dates. In this way, the plants mature at intervals throughout the harvest season, the faster-growing varieties first, the slower-growing ones later.

The virtue of this system is that the only uncertainty in the schedule is the weather during the harvest season itself. Details for making the climatic calendar appear in the *Journal of the Operations Research Society of America* (February, 1953).

Reprinted from Science News Letter

QUESTIONS and ANSWERS

phosphate rock for tomatoes

Q. My tomatoes have leaf curl. I have watered them heavily every other day during the dry weather and have mulched them with much straw and grassy material. I used lots of compost—phosphate rock and crushed limestone—with old sheep manure, and every two weeks give them weak liquid sheep manure. Am I doing the right thing?

A. Phosphate rock is very good for your tomatoes, as it contributes to earliness and to good yields. If your tomatoes are allowed to run on the ground, mulching is an excellent practice. It not only tends to retain moisture in the soil and smother weeds, but it keeps the fruit clean and helps provide a good accumulation of organic matter for next year. The tomato is a warm-season crop. It is sensitive to frost, but reasonably resistant to heat and drought and does very well in direct sun. Leaf curl usually occurs when tomatoes are exposed suddenly to very dry, hot weather. The leaves curl in an effort to reduce the loss of water from the leaves. On tomatoes this is usually not a disease, although there is a virus disease so named which affects other plants.

what of hydroponics?

Q. Recently there has been a flood of articles and subsequent commentary regarding developments in the field of hydroponics—that is, growing plants in water solution. To the aver-

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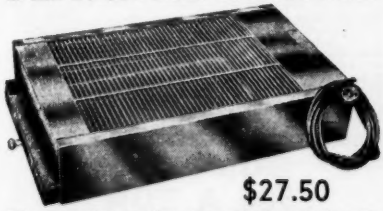

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BURKLEIGH COMPANY

Dept. 171, Towson, Maryland

age reader or gardener unfamiliar with laboratory technology and terms much of this current influx is either confusing or deluding. What is your opinion of this practice? Is there a sound basis for the assumption that quantities of produce may be grown in such solutions? Is there a difference that matters between farming on land or in test tubes?

A. We believe that hydroponics is a very unnatural method of raising food. Tests and analyses made by leading agronomists and soil scientists have revealed that plants grown in these solutions of chemically-treated water are in several ways inferior to those grown in good soil. Such wholly inorganic growth obviously prevents plant life from securing the necessary natural compounds of the soil which serve best for plant nutrition. Other detrimental results of this artificial practice include vitamin and mineral inferiority as well as definite poorness of taste.

community spraying dangerous

Q. Last year we had a scourge of army worms. Some spraying was done with harmful results. There is no telling how many bees and useful insects were killed. There is proof that the state fisheries suffered as a result of poisoned flies falling on the water, which in turn poisoned the fish. Now there is more spraying to be done this year. Just what chemical formula is used, I do not know, but isn't there danger of irreparable harm to the birds, the bees, and other useful insects? What about pollination if these are killed off? What can be used without harmful effects?

A. Such sprays are definitely detrimental to soil life, to beneficial insects and ultimately to plant, animal and human welfare. As you state, the important work of pollinators—on whom many tree and vegetable crops are dependent—is not only hindered, but

often completely destroyed. Increased use of insecticides is a serious threat to the very needed survival of bees and other beneficial insect life. Saturating the land and plant growth with chemicals is not nature's way. We advocate building a healthy soil that will be more resistant to insect attack, applying organic fertilizers supplemented by the use of natural rock powders, and employing sensible biological control methods in combatting insect pests, such as enlisting the aid of natural predators and parasites, birds, and insect disease inoculants.

muskmelons and insects

Q. I have ten hills of Hearts of Gold muskmelon which have thrived healthily for several seasons. My soil is in excellent condition. I have applied compost made from garbage, manure and seaweed which is available at a nearby lake. Also added have been natural phosphate and potash rock. About four weeks ago I noticed the underparts of some of the muskmelon leaves were covered with black aphids. Next, I found they were at the tender ends of the vines, which have since become wilted. I want to avoid spraying or dusting, but what can be done?

A. The introduction of ladybird beetles, which are commonly called ladybugs, into your garden is a definite answer for any of the aphids. These beneficial insects are voracious predators, and have been found especially effective in controlling aphids.

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forum

(*Continued from page 9*)

planting a new garden

After reading the articles on organic gardening and compost making in the first issue of my subscription to *Organic Gardening*, I became so interested that I immediately started a compost heap. The following spring we sold our home and bought two lots which were covered with brush. We had them cleared and built a house. The ground, however, was clay and small rocks. I built a three level terrace with the rocks in front of the house and hauled leaf mold and fine, half-decayed twigs from the woods and filled in the beds I had built. Then, I put a layer of compost about 4 inches thick over that and planted my flowers.

I have never seen flowers grow as fast as those did nor have such large blossoms.

I also made a trench about 18 inches deep at the south side of the house and filled it with the same mixture as I used for the other beds. I planted sweet peas and they grew to a height of 12 feet and had the largest blossoms I ever saw. It is now four years since I made those beds and I have never used any kind of chemical fertilizer. The flowers were as nice last year as they were the first. People look at my flowers and ask what brand of fertilizer I use and when I tell them none they are amazed.

I have some of my neighbors making compost, too, and they as well are finding out how it makes their flowers grow. I would like to have more people know what compost will do for their gardens and plants.

Mrs. John B. Bruch
Port Angeles, Washington

a feeding experiment

We have been making compost for several years and we do not have a bug on our rabbit ranch, not even cutworms or potato bugs.

I am trying an experiment this year. I have had red wiggler worms under the rabbit hutches for over a year now. This year, I am using just straight worm castings for the special things in the garden and in the flower beds.

We use a grade of commercial pellets which contain the best ingredients obtainable for the rabbits as well as the worms. We also feed alfalfa hay. The floors of the rabbit hutches are covered with a mesh wire, allowing the rabbit droppings, urine, rabbit pellets and alfalfa to fall through to the worms underneath, and thus making a wonderful feed for the worms. We use the worm castings in the garden.

The vegetables we raise have a better flavor and are truly healthier looking and both my husband and I enjoy better health since we have been using compost in the garden.

M. E. Hilburn
Irving, Texas

rejuvenating worn-out land

I have been subscribing to *Organic Gardening* since May, 1952, and so far it is the best investment I have ever made.

I have 17 acres of worn-out ground in the Ozarks that had been farmed to death for the last 75 years, absolutely nothing having been put back into the soil.

Last spring I planted a garden by using the organic method and despite the drought we had this past summer and fall, my garden survived while other gardens burnt up. I am there only on week-ends, as my farm is 80 miles from Saint Louis.

Last fall I planted two apple trees and a native told me that if I wasn't down there to spray the trees, the insects would eat them up. By using a mulch, rock phosphate, lime, ground

granite, and earthworms, the trees not only survived but grew considerably, despite the year's drought. I have never seen such beautiful trees. They have deep color and are free from insects.

I also built up one row for potatoes, which did not have any potato bugs whatsoever. The other potatoes I planted in poor ground were eaten up by the bugs. This proves that you are 100 per cent right.

Otto Aiple
St. Louis, Missouri

---

the organic country store

The Organic Country Store at the Rodale Experimental Farm is open through the summer months. Come in and browse around, 10 A. M. to 4 P. M., any day of the week, including Sunday. It is located just west of Allentown, Penna., off Route 222 toward Emmaus—map available on request.

The Country Store shelves are stocked with fertilizers, mentioned in our magazines: seaweed and dehydrated animal manures, phosphate, and potash rock (granite dust), peat moss and mulching materials, to list a few. There are food shredders, too, to save the vitamins in your garden vegetables; activators to speed the breakdown of the compost pile. Almost everything, in fact, for organic gardening needs, including booklets on all phases of organic gardening. We are sorry—no mail orders.

And while you are with us, take a tour of the farm. There is lots to see.

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greenhouse for children

An interesting project designed to interest youngsters in plant growth

KATHERINE B. WALKER, OKLA.

Too often adults pursue a "hands-off" policy with children, where plants are concerned, depriving themselves as well as the children of much pleasure. The children of today are the gardeners of tomorrow; they should be encouraged to learn about and enjoy plants.

Planters of all sizes and descriptions, dish-gardens, and other media wherein several plants are grouped harmoniously, have always had a special appeal for me. At times it is difficult to find new approaches, or new plant combinations, and the most recently done glass container seems to resemble too closely the one before it. Last year I was feeling "stale" just when I was asked to do a special planter for the kindergarten room at a school.

The precepts upon which most plant arrangements are based mean little to small children, and often a plant which finds favor with an adult may not rate a second glance from a youngster. I decided to let the little ones choose their own material, and work from there. I gave them free rein in my "wild" garden outdoors and in the window garden, vetoing their selections only when I felt the plants could not possibly be expected to live.

Within a short time they began bringing their finds to the kitchen table... a strawberry-begonia with runners and tiny plantlets on it, a Piggy-back with small plants started at the leaf bases, two seedling hemlocks, one seedling cedar, an African-violet, three tips from a small-leaved ivy, a clump of coarse grass, a Prayer-plant (*maranta*), a clump of hepaticas, three pieces of club-moss (grey with red clubs) and four pine cones. To say that it was a motley assortment would be an understatement. One small boy who had refused to go plant-gathering with the others added a little yellow china frog which he had found on a shelf. It was the only thing he had touched in nearly two hours, and his only words the whole afternoon were "he b'long."

After the material was gathered, we chose a fluted aluminum bowl about four inches deep, and put in a good layer of potsherds. (There is nothing like a group of kindergarteners, some hammers, and old flower pots for turning out good potsherds!) Then we added granulated charcoal and a thick layer of humus. We arranged the plants in the bowl, and each held his choice in position while I filled in around it with more humus.

The bowl was watered only enough to settle the plants and soil.

As I planted, I left one open spot and here, under an overhanging leaf, went Froggy. This, then, was our planter, and more beautiful than any other to the children because they had a part in it. Intended as a temporary piece for their room, it is now a permanent fixture and is doing fine.

Plants which "do things" are best for very young children. The Sensitive-plant will keep them happy for hours, folding its leaves and dropping the leaf-stems as they touch it. Plants which have "babies," like *tolmiea, anthericum,* or strawberry-begonia are interesting, and well-grown Hen-and-chickens often put out new plants fast enough to suit them. Plants with a nice feel, preferably fuzzy ones, are always popular. Children can be taught to touch leaves gently, and even African-violets and gloxinias will endure quite a lot of gentle stroking.

Because children do like to touch things, sharp-needled evergreens, cacti, or any plant with thorns, spines or sharp points should never be left within their reach.

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What is that all-important food element? It is the vital factor known as VITAMIN B-COMPLEX. As one food authority states, the B-Complex is supplied only meagerly in modern diets ... because excessive processing and over-refining are robbing our grains and cereal of this precious food element. As a result, many people over 35 who are victims of that tired, listless "middle age" feeling are often merely cases of Vitamin B-Complex deficiency. But adults alone are not the only ones this deficiency can strike and rob of precious energy and vigor. Research shows, too, that children, who in school lack enthusiasm for study or have no real zest for play, may also be suffering from B-Complex deficiency.

So, it seems only good sense to make certain that your daily diet (and that of your family) contains an adequate amount of B-Vitamins ... in natural form. Today thousands are doing just that ... by taking regularly:

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★ Formulators and Distributors of Diet Supplements from Natural Sources.

healthy house plants... ...all summer

Simple rules enable you to enjoy your vacation without harming your house plants

SOPHIA NAUMBURG, N. J.

Let the living green of your cherished plants stay with you through the hot months. They will help to bring the coolness and sparkle of the outdoors into your living room. Many modern decorators include house plants in their summer interior plans. Perhaps they are borrowing and enlarging on Grandma's idea of hiding her fireplace with a grouping of Boston ferns. However, they demand special care if they are to remain indoors, in top condition during this difficult season.

When the sun first becomes warm, plants must be moved from their customary windows either back into the room, or into another window, where they receive less sunlight. An east or west window in summer is equal in sunlight, to a south window in winter while a north window in summer is equivalent in sunshine to an east or west window in winter.

Give the plants plenty of fresh air, but keep them out of drafts. Plants dry out more quickly in summer and require more frequent watering. A mulch of grass clippings, peat moss, leaves, hay or buckwheat hulls will help keep moisture in the soil and the roots cool.

If the roots are crowded, this is the time to transplant to a larger pot. Most house plants are able to adjust to the shock of repotting, if this is done in the spring of the year, when the plant is strong and growing vigorously. Do this just before you move them back to a more sheltered position out of the increasing heat and strength of the sun.

Most flowering house plants need to be root-bound in order to bloom. The one exception is African violets. All of the larger foliage house plants need to have their roots restricted, but for a different reason. These have a tendency to become too large for the average home, and a small pot will stunt their growth.

If the roots start to come through the hole in the bottom of the pot, this may be a sign that the plant needs repotting. Too small a pot causes the plant to dry out too quickly and wilt. Too large a pot is also detrimental to the growing plant as the soil has a tendency to become waterlogged. Therefore, when transplanting, use a pot only one size larger. The longer you can postpone re-potting, without injury to the plant the better.

Do not worry about feeding the potted plant. If you use the proper soil mixture when the plant is repotted, it will not suffer until the roots have used up all the available

nourishment in the soil. Garden compost which has been sifted thoroughly makes a fine potting mixture, for most house plants.

There are two groupings of house plants that require slightly more preparation in their soil mixtures. The first, seedlings and cuttings require a lighter soil. Sand and peat moss are added to the sifted garden compost in a sufficient quantity to allow a larger amount of air to circulate into the soil. The second grouping is that of succulents and cacti. They also take a lighter and not as rich a mixture of potting soil as most other plants. Sand and broken flower pots or crumpled bricks are usually added to the compost to please these natives of dry places.

If you can catch rain water for your house plants you will be well rewarded by their luxurious growth. Natural rain water carries plant magic that no amount of syringing with the chemically treated reservoir water can equal. Frequent sprinkling of the foliage of smooth-leaved plants is important. This will not only keep them free of dust and insects, but also create more moisture in the air, which is vital to their health.

Just as vital, and even more so, is a moist soil for the growing of potted plants. The heat of summer will dry them out more quickly and wilting will become more of a problem than it is during the winter months. The easiest method of watering is by pouring directly on the soil. This is not the best for the health of the plant. It has a tendency to pack the soil solid and very little air can circulate into the soil. A better way is to water the plant by standing it in a saucer or pail of water. Allow it to stay here until the soil is moist, but not indefinitely as this will cause the soil to turn sour.

So that drooping, discouraged or dead potted plants do not greet you on your return home after a week's vacation, give a little extra care to them before you go away. Place those in clay pots in a second one which is preferably waterproof and at least three inches larger. In the "trench" thus formed, pack water-soaked peat moss, it will conserve the moisture in the pot containing the plant and this, too, should be properly watered before you leave for that short vacation.

Very few house plants can take the full sun of a south window in summer. If you cannot move them, a shade or tinted glass curtain will give some protection from burning. The following plants will grow in such a window, or better still (in summer) in an east or west location:

African violet,
amaryllis,
artillery plant,
asparagus fern,
begonia,
caladium,
Christmas cactus,
coleus,
coral berry,
corn plant,
croton,
crown-of-thorns,
grape ivy,
flowering maple,
patience plant,
pothos,
prayer plant,
screw vine,
geranium,
lantana,
oxalis,
shrimp plant,
strawberry begonia,
succulents,
sweet olive,
wandering Jew,
wax begonia,
wax plant.

Some plants do not need sun in order to live and thrive. A north window or even a location near the source of light will do. From such a list as the following we can draw favorites for a cooling mass of green to decorate our summer living quarters:

African evergreen,
Apostle plant,
cast-iron plant,
Chinese evergreen,
dumb cane,
ferns,
fig family,
ivy,
jade plant,
philodendron,
pick-a-back plant,
snake plant,
spider plant,
Swiss cheese plant,
watermelon begonia.

Summer is indeed difficult for those who must remain indoors. House plants, just like humans, wilt in extremely high temperatures; therefore, the cooler the spot in which you can place them, the happier and healthier they will be.

Reprinted from PREVENTION

free food

Food that grows wild is free for the taking

JEANNE PONTIUS RINDGE, N. Y.

Good fun, good nutrition, good health—all for free—await you in the country during the long months of summer. Wild fruit—nature's own bountiful gift—hangs in succulent clusters, or half-hidden beneath lush leaves. A little search will find them—in the hedgerows, woods, and along the country roadsides. Why not enjoy them?

Wild fruit is sometimes slow of picking, compared to the commercial variety, but—when you consider that nature has done all the work of providing it—picking labor is negligible.

There is a holiday spirit to picking wild fruit—children love it, and city folk as well. Make a party of hedgerow picking and enjoy the results for months to come.

There is a zip to the tang of wild fruit which no cultivated fruit can claim. The mouth waters in anticipation of the taste treat of jams and jellies made from wild berries, cherries and crab apples.

More important is the fact that these foods are raised as nature would have them raised—without man's "civilized" tampering. In the wild regions, the woods, and even in the hedgerows, nature conducts her own cycle of life, death and ever-constant rebirth. Falling leaves, accumulating "trash" of twigs, stones and grasses form a warm blanket over the soil which, as it decays and breaks down, gives a natural organic fertilizer filled with nourishing and all-important minerals. Wild fruit often is small, but it is a vital food, filled with natural goodness.

First fruit of the season is the succulent wild strawberry. This plant is so sacred to the Indian that it is thought to grow along "the heaven road." The Great Spirit, through the venerable Iroquoian prophet Handsome Lake, told his people that "the juice of the strawberry is a medicine, and the sweet water of the earliest strawberries is a very great medicine."

The Indians were right about the value of the wild strawberry. Modern research has found it to contain a large quantity of Vitamin C, ascorbic acid, so essential to health.

In many parts of the Northern states, the next comer is the wild cherry—whose feathery white blossoms are one of the first heralds of Spring.

A few of the wild cherries are bitter, but many—both black and red—are very sweet, although somewhat smaller than the cultivated variety. Many of the trees in Western New York are descendants of Indian cherry trees. These, along with apples and plums, were cultivated by the Senecas in this area, "children" of all three fruits becoming scattered throughout the region.

Wild cherries make wonderful jam, freeze easily and keep their shape. They are usually placed in sugar syrup for freezing, but can freeze just as successfully without sugar. Used in the place of "bing" cherries in gelatine salads or desserts, they create a flavor fit for a gourmet. Eaten "raw," immediately after thawing, while still firm, the fruit retains the taste and quality of fresh-picked cherries—a heavenly treat in January.

Before the cherries are gone, the red and black raspberries appear—followed by the heavier-flavored blackberry. These used alone, or in jams and jellies are favorite dishes. Combine them with the cherries for unusual flavor. Jams and jellies of these various combinations will fill a Christmas "shopping list" in a delightful way which cannot be duplicated by the best city delicatessen.

In many a hedgerow corner there is a mulberry bush, or even a tree. This thimble-shaped, delicately sweet fruit is nectar for birds, squirrels, and small boys. Many old recipe books give directions for making mulberry "cordial." In old Bohemia, the Czechs have a favorite drink, called "malinova," made from mulberry juice and carbonated water. It takes the place of our Yankee "cokes"—and is far more healthful.

A stranger to many Eastern tables is the choke cherry, (some even consider it a poison). In the West, it is considered such a delicacy that people will scramble for hours through briars and over rocks to collect a few pounds of the fruit, especially for jelly making. The grape-like clusters of tiny cherries are bitter to the taste when raw. In jelly, the choke cherry flavor is very delicate, unlike that of any other fruit. Any cherry jelly recipe may be used.

Bane of many a farmer's existence is the wild grape, whose twining vines garland every hedgerow. The tang of wild grape flavor—in jelly or juice—is something never to be forgotten. There seems to be an affinity between the wild grape and the wild raspberry and blackberry—the largest and juiciest berries often are found beneath the leaves of an enveloping wild grape.

One of the most neglected of all fruits—and one of the most valuable—is the elderberry, whose clusters of white blossoms and palmlike leaves are a pleasant sight in the hedgerow. The elder bush is a pharmacy in itself, every part of it can be used for medicinal purposes—flowers, leaves, leafbuds, inner bark and berries.

Elder-blow tea (an infusion of the flowers), when cold, is an alternative and laxative. When hot, it becomes an excitant. The inner bark is used in preparing ointments. The berry juice is a cooling laxative drink, and the medicinal "elderberry wine" is famous. The unopened flower buds can be pickled and used as capers. Pith from the stem furnishes the best pith balls for electrical experiments.

Ancient herbalists' books abound in elder lore. It supposedly cured the bites of adders and mad dogs, and was an invaluable medicine for quinsy and sore throat.

Modern research shows the berry to be richer in ascorbic acid than any garden fruit except black currants. When picked before they are fully ripe, three quarters of a cup of berries will yield three milligrams of Vitamin C—comparing favorably with orange juice.

The fruit is easily gathered by clipping off whole bunches with knife or scissors. After washing in cold water and draining, the berries are most easily "unstemmed" by rubbing gently across the "tennis racket" type wire egg beater, or across a french-fry potato cutter.

An improved variety, with fruit one-fourth inch in diameter, has been introduced by the N. Y. State Experiment Station in Geneva. They need the wild variety nearby for cross-pollination. The best way to use elderberries is in the form of juice.

Wild blueberries are a universal favorite in regions where they can be found.

Nature is bountiful if we take the time to collect her harvest. It is free for the taking—and insures us the most nutritious and delectable of eating. Why not accept her offer?

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VARIED EFFECTS

Calcium deficiency may have associated with it muscular cramps of various types. Calcium is also one of the important factors in regulating action of the heart muscles. It strengthens the tone of the heart beat. Calcium in addition has an important role in the body in the clotting or coagulating of blood.

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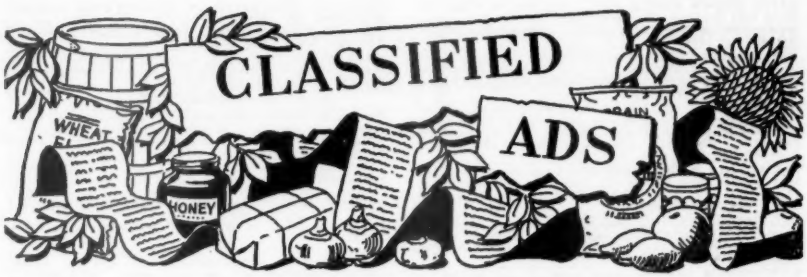

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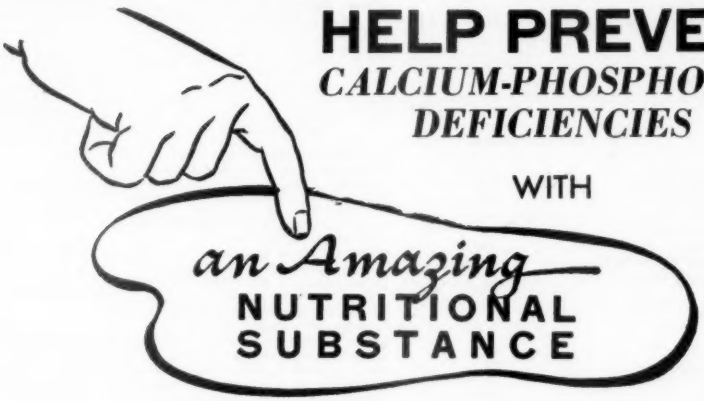

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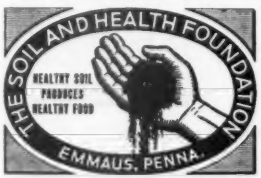

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PROFESSIONAL TYPE FOOT EXERCISER
For Home Use

- FINISH — Beautiful Soft Blue Baked Enamel with Chrome Trim. Removable White Rubber Massaging Cushion.
- COMPACT POWER UNIT
- ON-OFF SWITCH
- NO OILING REQUIRED
- SPECIFICATIONS:—
  110-120 Volts
  50 - 60 Cycles
  AC Only — 6-ft. Cord
- FULLY GUARANTEED
- INDIVIDUALLY PACKED
  Six to a Shipping Carton
  Shipping Weight 18 lbs.
- Extra Rubber Massaging Cushions Available to Retail at $1.00 Each

- Approved by the NATIONAL FOOT HEALTH COUNCIL for Better Foot Care
- Use Few Minutes Daily to Relieve Tired — Aching Feet by a Stimulating Massage
- The HANDY HANNAH FOOT VIBRATOR is Designed for Home Use to Stimulate Blood Circulation and Improve Muscle Tone — Easily and Pleasantly
- Easy and Convenient to Use

APPLY LIGHT PRESSURE WHEN PLACING FOOT ON VIBRATOR RUBBER CUSHION.

GIVE YOUR FEET THIS VIBRATOR MASSAGE AND EXERCISE FOR FIVE MINUTES DAILY TO RELIEVE THE DISCOMFORT OF TIRED MUSCLES AND ACHING FEET.

GOOD CIRCULATION IN THE FEET CONTRIBUTES TO GOOD HEALTH — REGARDLESS OF AGE.

RETAIL $7.95

For the Front Arch and Toes

Sturdily Constructed For Long and Trouble Free Service

STUR-DEE HEALTH PRODUCTS
238 LIVINGSTON STREET BROOKLYN 2, N. Y.
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For Arch and Leg Muscles

Order Direct Postpaid ● Satisfaction Guaranteed.

Summer Protection for Your Hair

FalMay

THREE - WAY

NATURAL HAIR TREATMENT

For Glowing, Lovely Hair Highlights

MASTER-FORM HAIR CREME...new and natural

Here's a scientific but entirely natural and organic preparation for care of hair and scalp. Formulated from a base of pure Lanolin, Cholesterol, Carotene, Wheat Germ Oil (Hormone E Factor) and Methionene (many authorities say this element is essential in eliminating hair splitting and breaking). Not only does MASTER-FORM HAIR TONE tend for healthier hair, but it has proven ideal as a hair groom. Brings out all the natural highlights in your hair (gray hair becomes silvery gray—brunette becomes rich natural brown—black becomes blue black—red becomes golden red). Hair color is unchanged... natural highlights are accentuated. Three convenient sizes:

4 oz. (60-day supply) **$1.75**
8 oz. (120-day supply) **3.00**
16 oz. (Jumbo Family size) **5.00**

Try this new aid to beautiful, healthy hair... add shining new lustre tones!

GREEN FOAM SHAMPOO

A Natural Oil Shampoo for that Soft, Silky Natural Hair Beauty

For a wonderful new "feel" to your hair... for clean sparkling highlights and gorgeous natural charm... try new, different GREEN FOAM Shampoo.

Now... at last... here is a soft, gentle yet truly effective shampoo made entirely from natural oils. GREEN FOAM Shampoo is entirely free from harsh alkali soaps and irritating detergents (known now to cause dryness). GREEN FOAM Shampoo was developed by FalMay in response to demand for a natural hair cleanser.

This foaming green scalp and hair cleanser is highly concentrated. Apply only a few drops. Your hair billows out in a foaming lather. Dirt, dandruff and other hair accumulations are surrounded, picked up and ridden away on a wave of suds. Leaves your hair soft and lovely, your scalp pink and clean. Order GREEN FOAM Shampoo today for soft, clean, lovelier hair!

6 oz. bottle—$1.50 **2 bottles for $2.50**

VIBRA-TONE HAIR BRUSH

NEW and DIFFERENT!

Tingling Care of Scalp and Hair

Yes, it's an entirely new idea... stainless steel bristles (round tips) anchored in foam rubber. This combination gives a firm, yet amazingly gentle "vibrating" action as you stroke your hair. The brush almost feels "alive" in your hand.

Or press brush firmly until bristles meet scalp, move hand gently back and forth. Then watch how fast the "vibrating" action loosens itching dandruff, makes scalp feel alive and tingling.

Vibra-Tone Hair Brush has a one-piece back and handle... solid walnut. Bristles and mounting are stainless steel... gleaming, rust-proof. Easy to clean... made to last a lifetime. Order one for each member of family.

Only $1.00 or 3 Brushes for $2.75

FALKNER & MAY, Inc.

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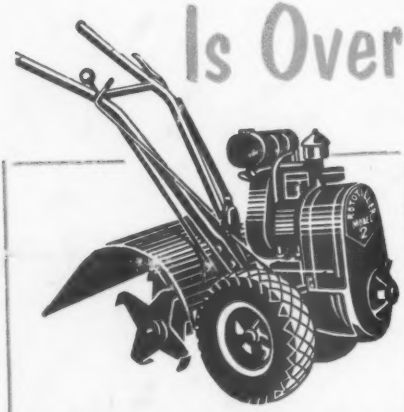
Organic Gardeners:

BE SURE TO READ THIS

If Your Garden Tractor Is Over 2 Years Old!



THE **ALL-NEW 1953**

GASOLINE-ELECTRIC

Lightning ROTOTILLER

*Reg. U.S. Pat. Off.

HERE are some of the revolutionary improvements developed by ROTOTILLER during the past two years. They can mean so many big differences to you as an Organic Gardener, that you'll find it to your advantage to trade in your present machine—*even if it's as little as two years old!*

ROTOTILLER'S brand-new "Chopper Digger" blades do the whole job of preparing your seed bed in ONE quick, easy operation. These *unbreakable, tangle-resistant* wonder blades are perfect for THREE other important jobs: cultivating; composting, *right in the garden itself;* and organic lawn making and re-making. ROTOTILLER'S new Lightning-Change LAWN MOWER operates with amazing new speed, as fast as a man can comfortably walk. The new ROTARY MOWER Attachment becomes part of the ROTOTILLER itself, so that the full horsepower and added weight really "murder" weeds, tall grass, and brush. *And that's not even half of the wonderful new Rototiller story!*

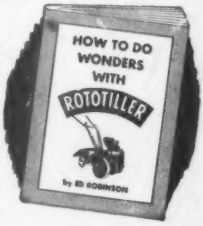
New SPEED and New EASE of Operation!

The new FASTER 1953 ROTOTILLER will "breeze through" countless other jobs for you—*the year 'round.* In LESS than 60 seconds—with low-cost Lightning-Change Attachments—it plows snow, does light bull-dozing, pumps water, hauls heavy loads, cuts wood. You can use it for grading, fertilizer spreading, spraying, buckraking, even generate emergency electric power with it—ALL with new SPEED . . . new EASE of operation . . . *and at amazing low cost!*

NO pushing, NO pressure, NO bearing down needed. You simply steer and *let ROTOTILLER go to work by itself!* So easy to handle, so simple to operate—that women and even children can use it. A "snap" to service; needs less care than a new car. Does the work of a DOZEN lawn and garden machines in ONE!

FREE Book Tells the Whole Wonderful Story

If you have no garden machine—or your present one is over two years old, you owe it to yourself to read the whole exciting story of what the new FASTER 1953 ROTOTILLER can do for you. Mail coupon now for FREE book "How To Do Wonders with ROTOTILLER" by Ed Robinson, author of the famous "Have-More" Plan. Ed's new 68-page, picture-packed book goes into many other valuable uses for this new wonder machine. It's a real eye-opener as to what modern engineering skill has done in the last two years to make organic gardening easier and more fun for you. So mail the coupon NOW to: **Rototiller, Inc., Dept. 77, Troy, New York.**



MAIL THIS FOR FREE BOOK

ROTOTILLER, Inc., Dept. 77,
Troy, New York

Please send me postpaid, by return mail, a FREE copy of your 68-page book telling me all about the New Lightning-Change ROTOTILLER and its many wonderful Lightning-Change Attachments.

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